US009470412B2

(12) **United States Patent**
Kasuga

(10) **Patent No.: US 9,470,412 B2**
(45) **Date of Patent: Oct. 18, 2016**

(54) **LIGHTING DEVICE**

(71) Applicant: **SEIKO EPSON CORPORATION**, Tokyo (JP)

(72) Inventor: **Hirofumi Kasuga**, Matsumoto (JP)

(73) Assignee: **SEIKO EPSON CORPORATION**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 125 days.

(21) Appl. No.: **13/955,414**

(22) Filed: **Jul. 31, 2013**

(65) **Prior Publication Data**

US 2014/0043544 A1 Feb. 13, 2014

(30) **Foreign Application Priority Data**

Aug. 10, 2012 (JP) 2012-178146

(51) **Int. Cl.**

G03B 21/10	(2006.01)
G03B 21/14	(2006.01)
F21V 33/00	(2006.01)
H04N 9/31	(2006.01)

(52) **U.S. Cl.**

CPC ***F21V 33/0052*** (2013.01); ***G03B 21/10*** (2013.01); ***G03B 21/145*** (2013.01); ***H04N 9/3141*** (2013.01)

(58) **Field of Classification Search**

CPC G03B 21/14; G03B 21/10; G03B 21/145; G03B 29/00; G03B 21/56; H04N 9/3141; F21V 33/0052

USPC 353/74, 119

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,736,530	B2	5/2004	Thevenot	
2005/0105055	A1*	5/2005	Olson	G03B 21/14 353/30
2006/0203212	A1*	9/2006	Held	F21S 6/006 353/119
2007/0146647	A1*	6/2007	Sarayeddine	G02F 1/1336 353/77
2009/0015799	A1*	1/2009	Luciano	353/79
2011/0205456	A1*	8/2011	Mizoguchi et al.	349/5

FOREIGN PATENT DOCUMENTS

JP	2005-527949 A	9/2005
JP	2006-302727	11/2006
JP	2010-217825 A	9/2010

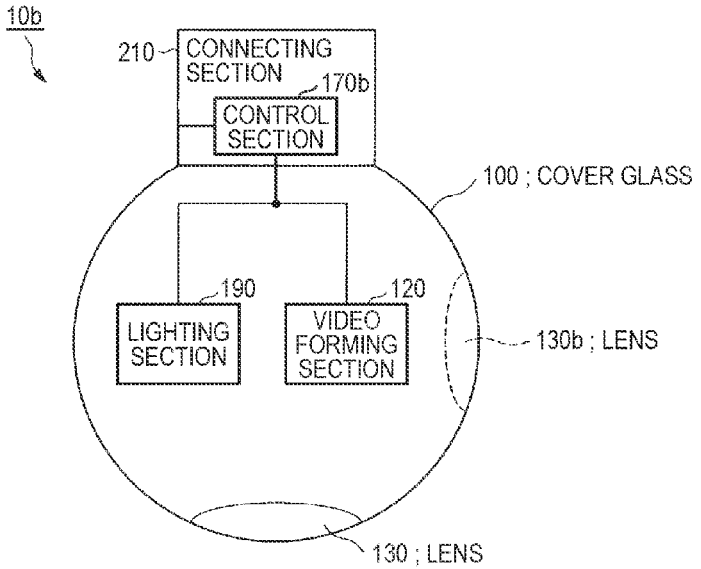
* cited by examiner

Primary Examiner — William C Dowling
Assistant Examiner — Ryan Howard
(74) *Attorney, Agent, or Firm* — Maschoff Brennan

(57) **ABSTRACT**

A lighting device includes a lighting unit and an enclosure (e.g., a shade) configured to cover a part or all of the periphery of the lighting unit and transmit light from the lighting unit. The lighting unit includes a light source section for lighting configured to radiate light and a video forming section configured to form video light obtained by modulating, on the basis of video information, light from a light source section for video formation configured integrally with or separately from the light source section for lighting and project the video light on the enclosure.

6 Claims, 12 Drawing Sheets



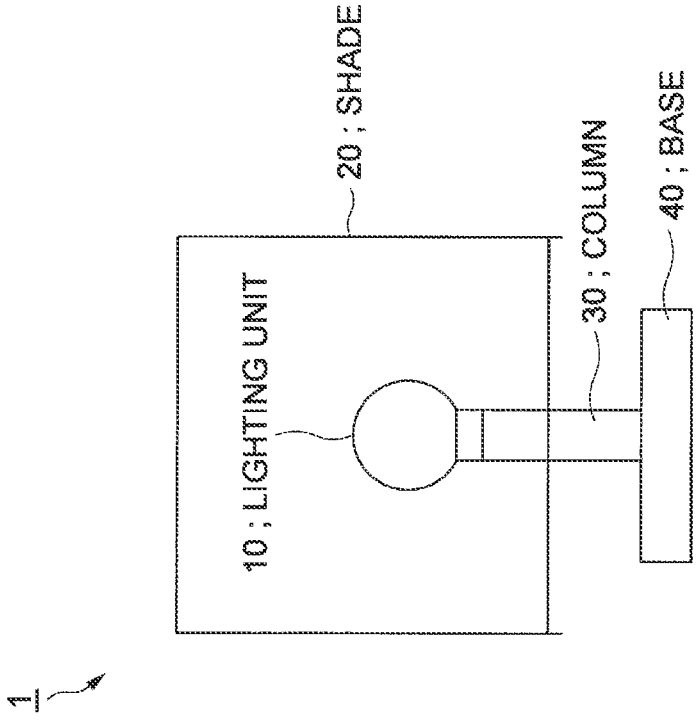

1
10 ; LIGHTING UNIT
20 ; SHADE
30 ; COLUMN
40 ; BASE

FIG. 1B

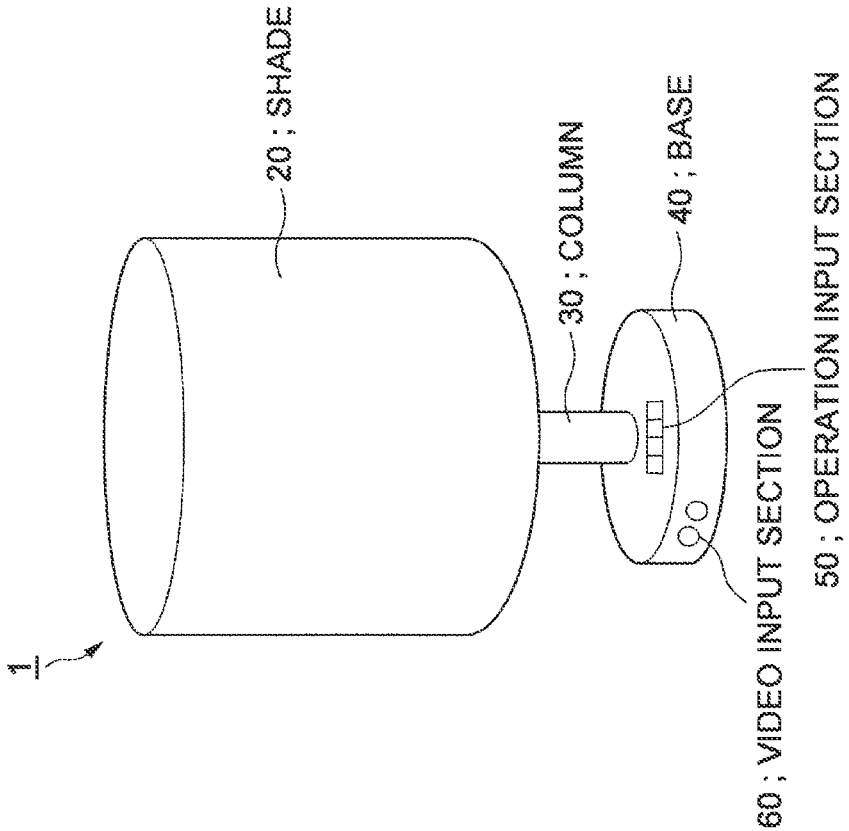

1
20 ; SHADE
30 ; COLUMN
40 ; BASE
50 ; OPERATION INPUT SECTION
60 ; VIDEO INPUT SECTION

FIG. 1A

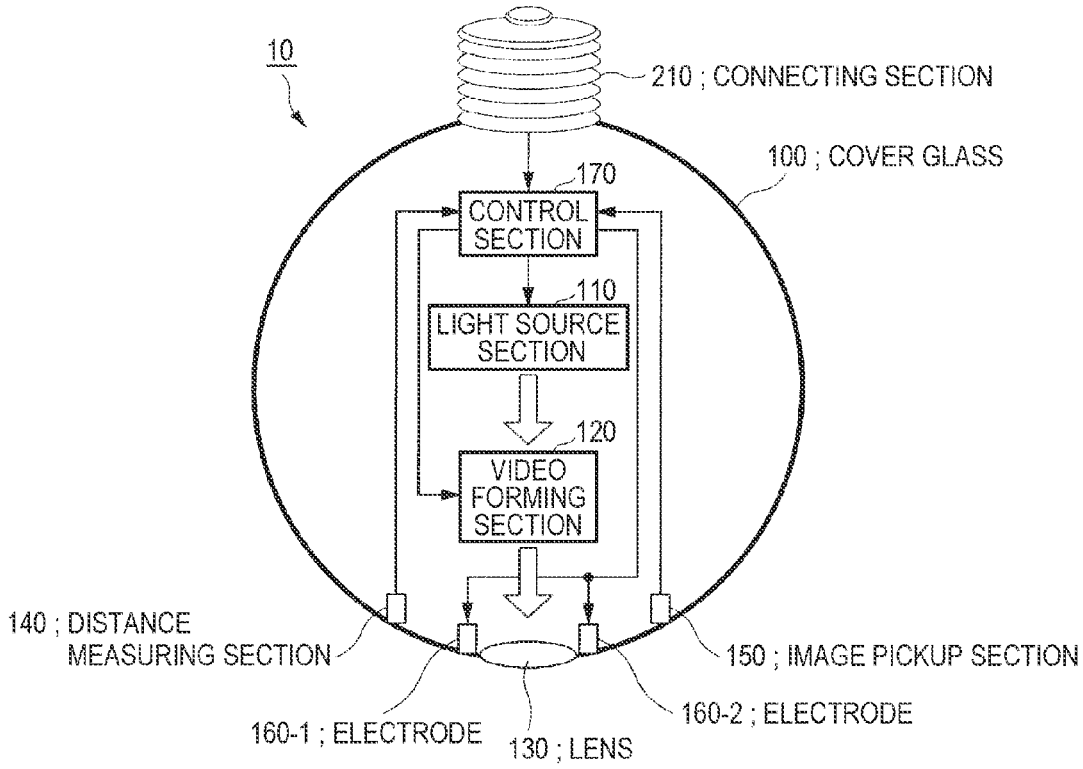

10
210 ; CONNECTING SECTION
100 ; COVER GLASS
170
CONTROL SECTION
110
LIGHT SOURCE SECTION
120
VIDEO FORMING SECTION
140 ; DISTANCE MEASURING SECTION
150 ; IMAGE PICKUP SECTION
160-1 ; ELECTRODE
130 ; LENS
160-2 ; ELECTRODE

FIG. 2

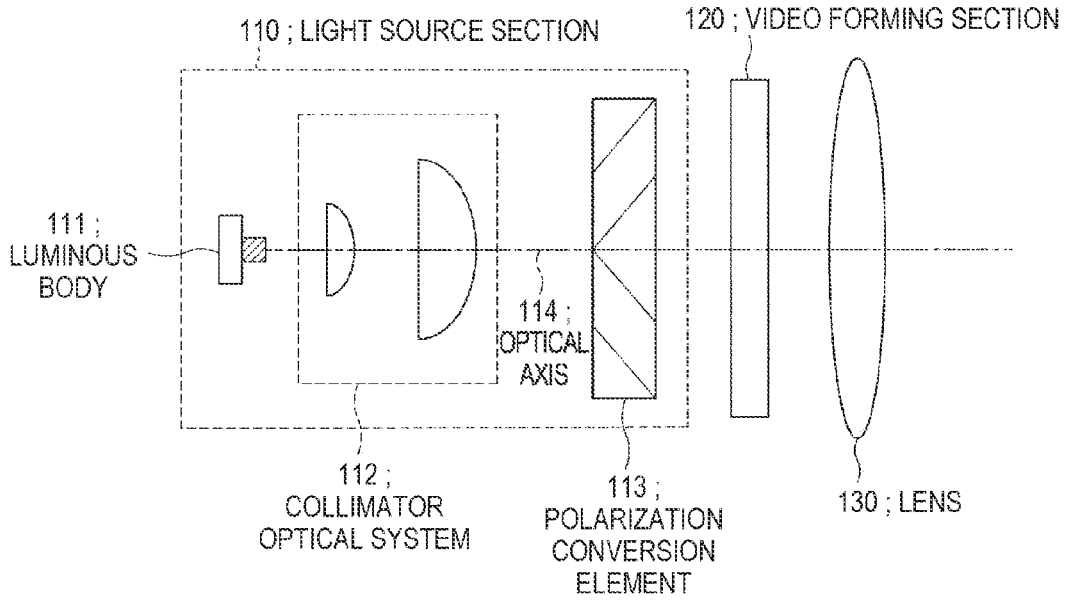

110 ; LIGHT SOURCE SECTION
120 ; VIDEO FORMING SECTION
111 ; LUMINOUS BODY
114 ; OPTICAL AXIS
112 ; COLLIMATOR OPTICAL SYSTEM
113 ; POLARIZATION CONVERSION ELEMENT
130 ; LENS

FIG. 3

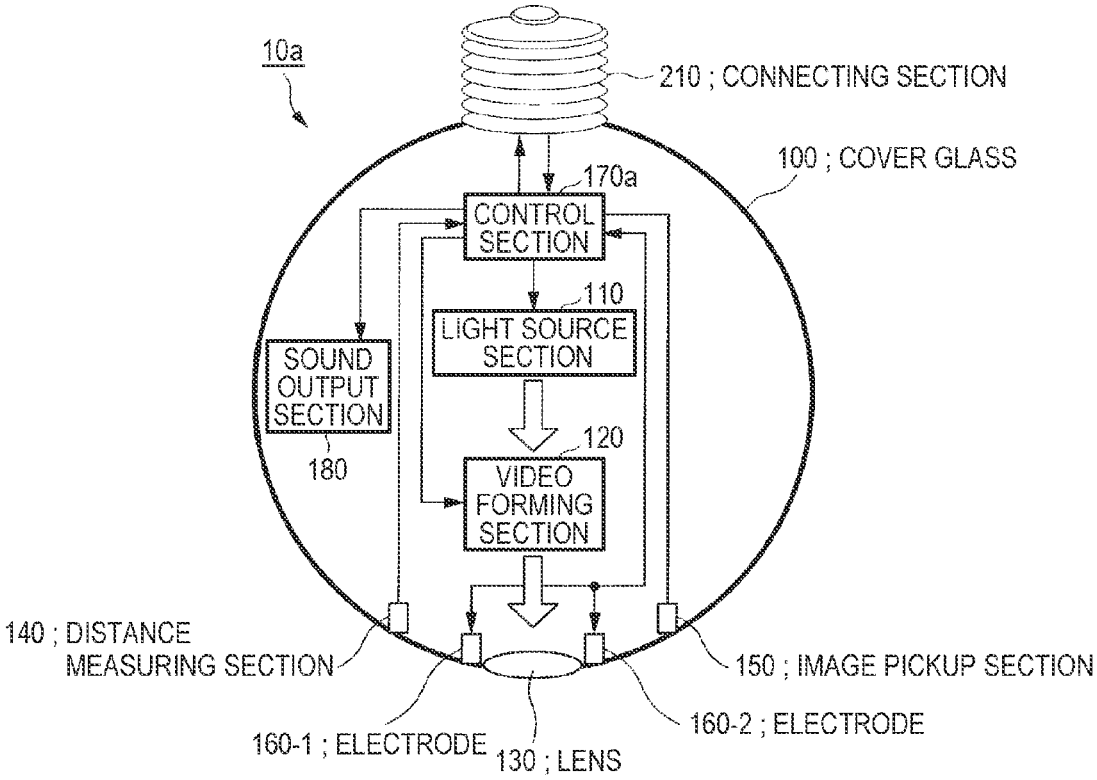

10a
210 ; CONNECTING SECTION
100 ; COVER GLASS
170a
CONTROL SECTION
110
LIGHT SOURCE SECTION
SOUND OUTPUT SECTION
180
120
VIDEO FORMING SECTION
140 ; DISTANCE MEASURING SECTION
150 ; IMAGE PICKUP SECTION
160-1 ; ELECTRODE
130 ; LENS
160-2 ; ELECTRODE

FIG. 4

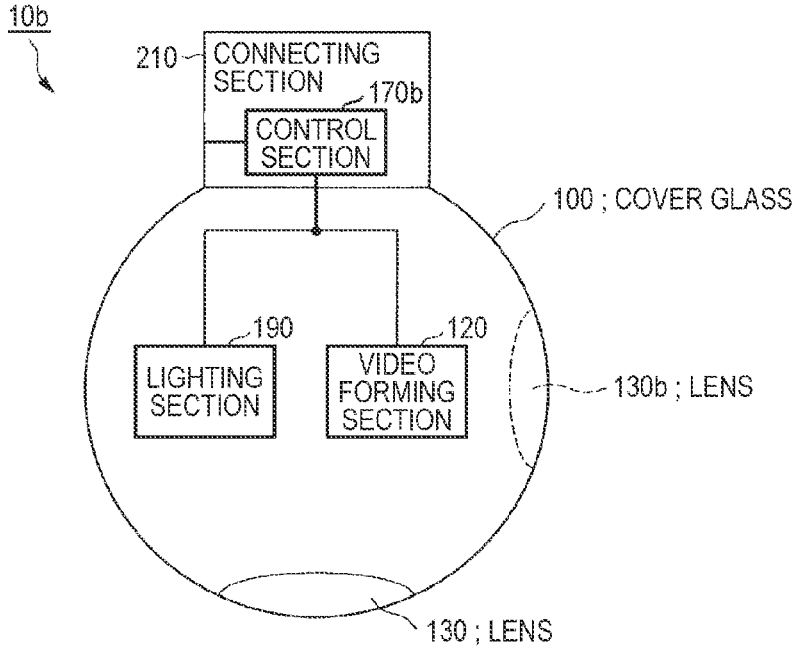

10b
210
CONNECTING SECTION
170b
CONTROL SECTION
100 ; COVER GLASS
190
120
LIGHTING SECTION
VIDEO FORMING SECTION
130b ; LENS
130 ; LENS

FIG. 5

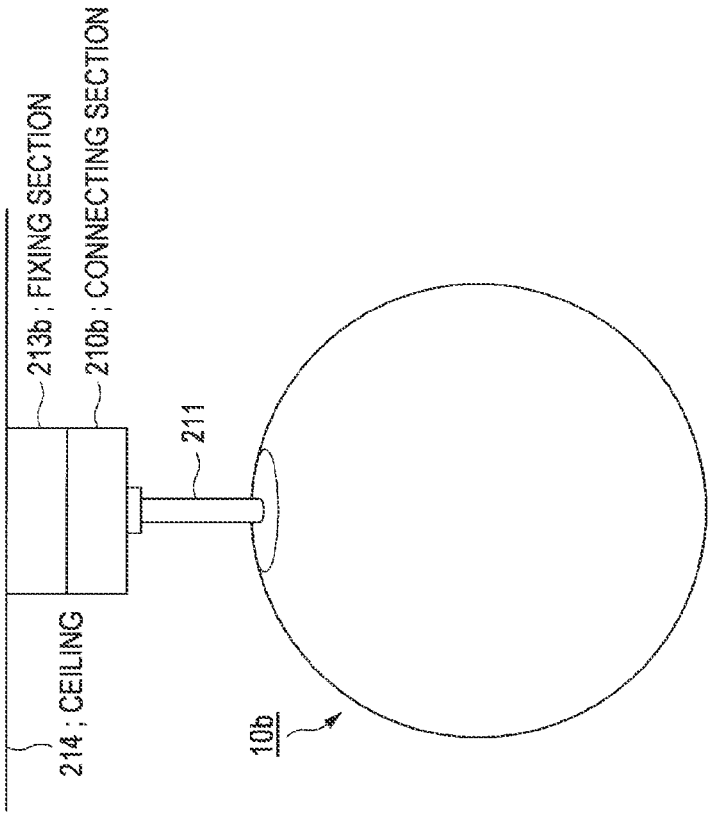

213b ; FIXING SECTION
210b ; CONNECTING SECTION
211
214 ; CEILING
10b

FIG. 6B

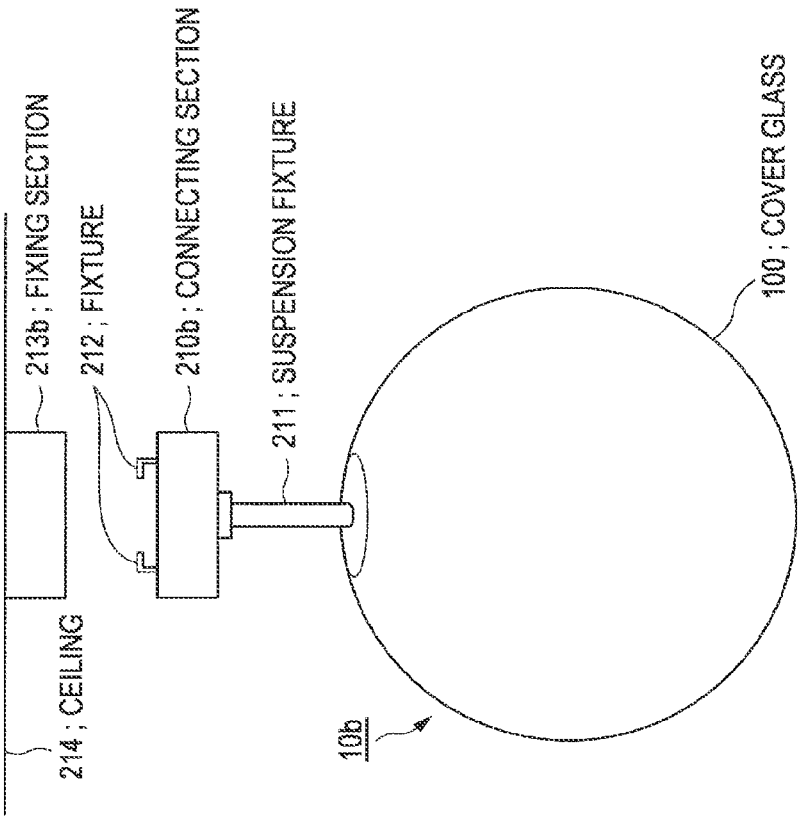

213b ; FIXING SECTION
212 ; FIXTURE
210b ; CONNECTING SECTION
211 ; SUSPENSION FIXTURE
100 ; COVER GLASS
214 ; CEILING
10b

FIG. 6A

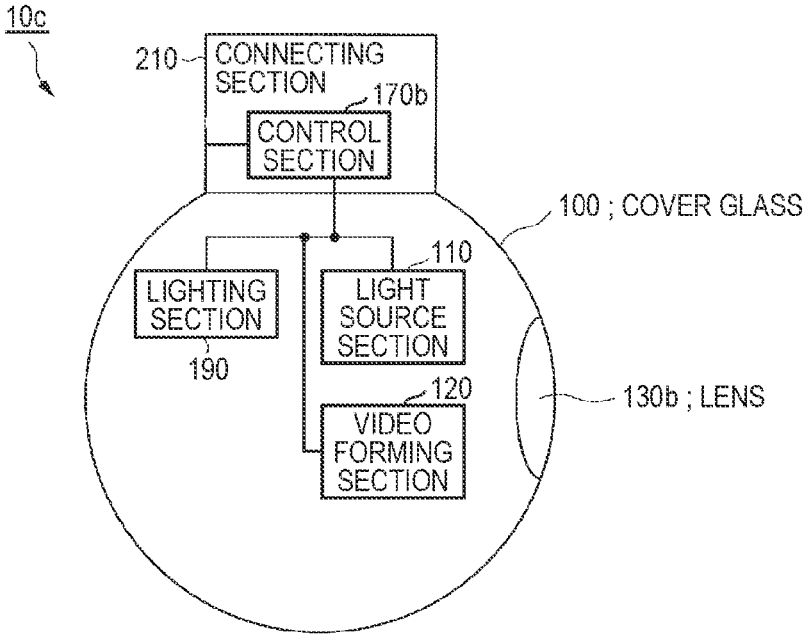

10c
210
CONNECTING SECTION
170b
CONTROL SECTION
100 ; COVER GLASS
110
LIGHTING SECTION
190
LIGHT SOURCE SECTION
120
VIDEO FORMING SECTION
130b ; LENS

FIG. 7

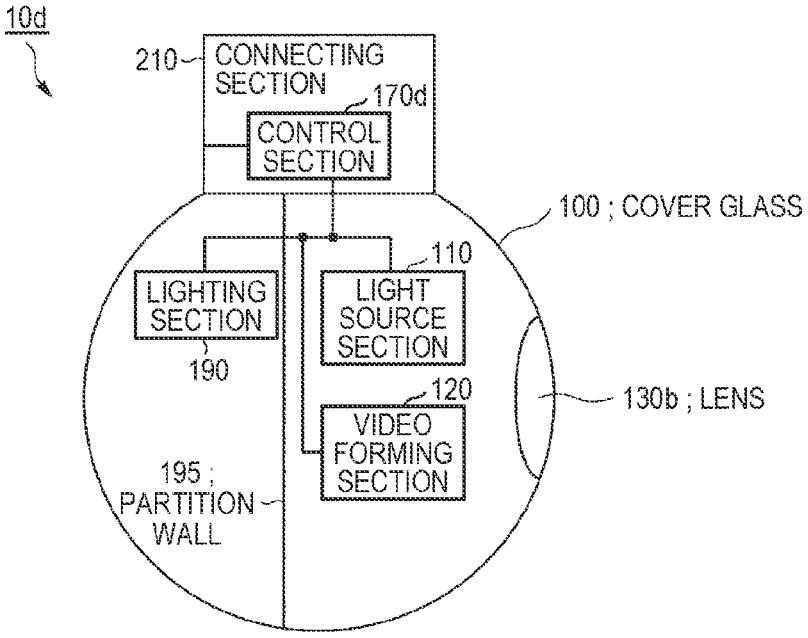

10d
210
CONNECTING SECTION
170d
CONTROL SECTION
100 ; COVER GLASS
110
LIGHTING SECTION
190
LIGHT SOURCE SECTION
120
VIDEO FORMING SECTION
130b ; LENS
195 ; PARTITION WALL

FIG. 8

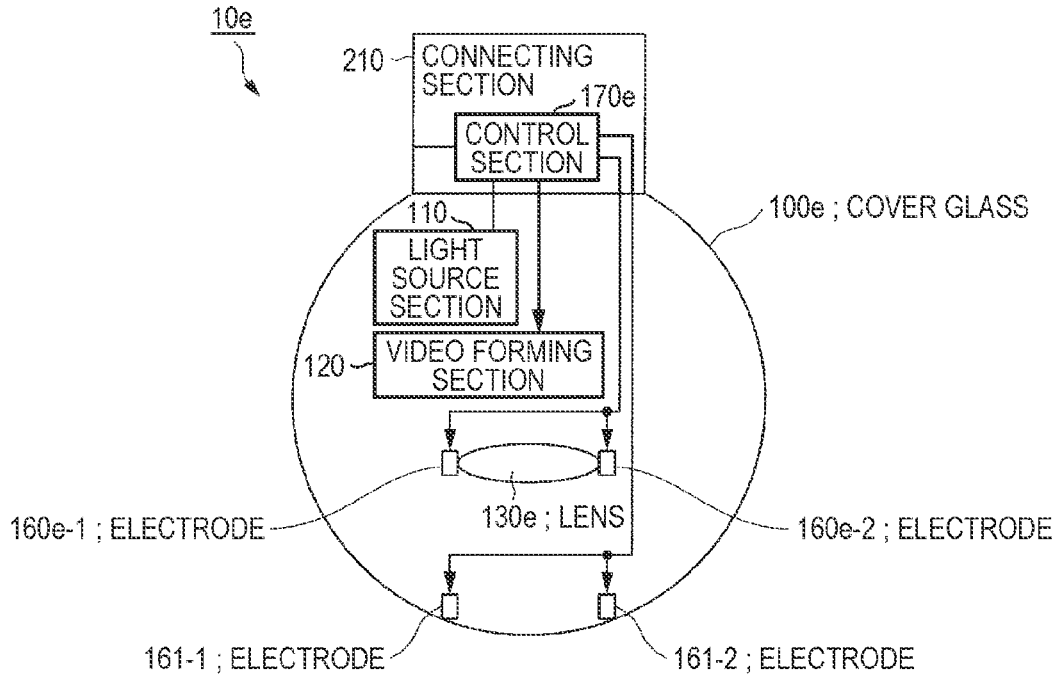

10e
210
CONNECTING SECTION
170e
CONTROL SECTION
100e ; COVER GLASS
110
LIGHT SOURCE SECTION
120
VIDEO FORMING SECTION
160e-1 ; ELECTRODE
130e ; LENS
160e-2 ; ELECTRODE
161-1 ; ELECTRODE
161-2 ; ELECTRODE

FIG. 9

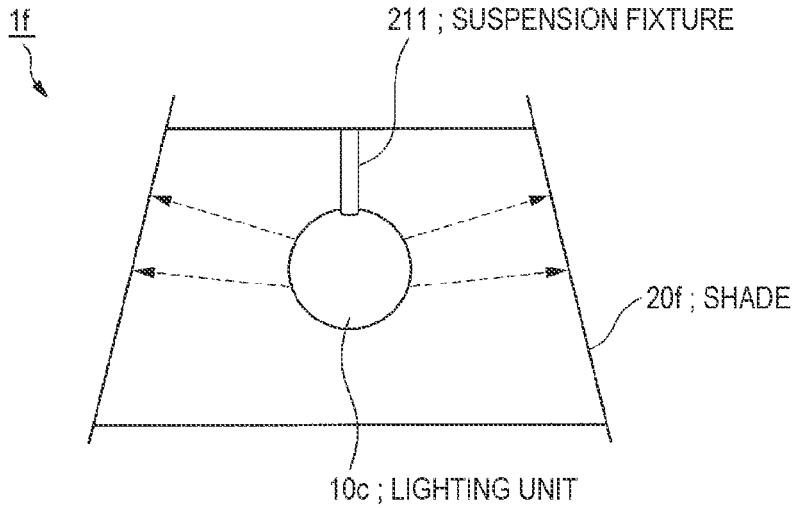

1f
211 ; SUSPENSION FIXTURE
20f ; SHADE
10c ; LIGHTING UNIT

FIG.10

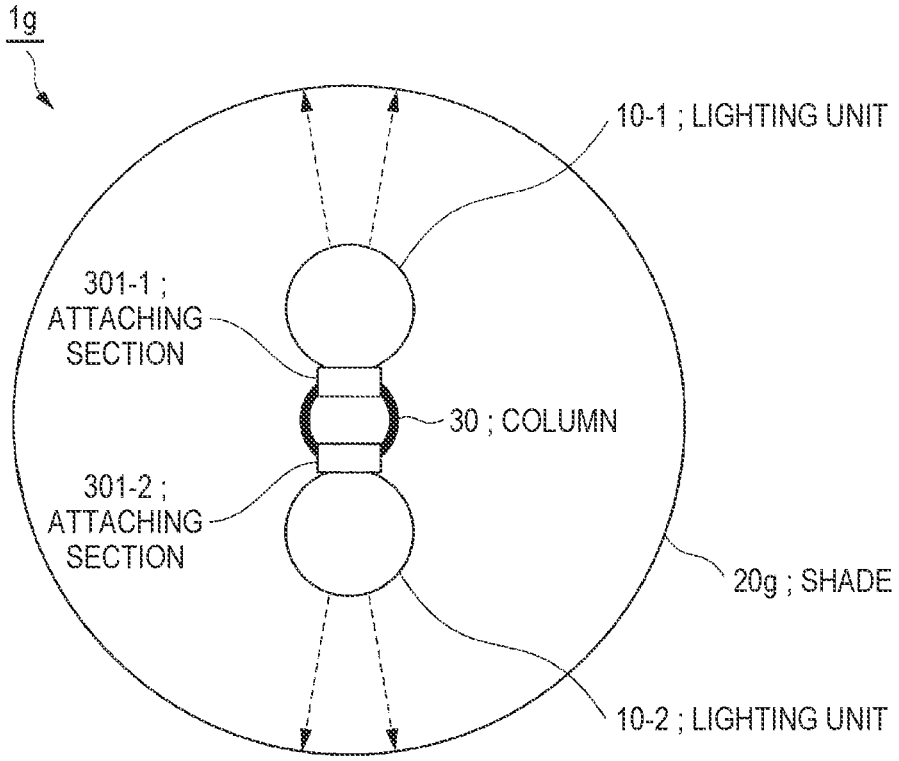

1g
10-1 ; LIGHTING UNIT
301-1 ; ATTACHING SECTION
30 ; COLUMN
301-2 ; ATTACHING SECTION
20g ; SHADE
10-2 ; LIGHTING UNIT

FIG.11

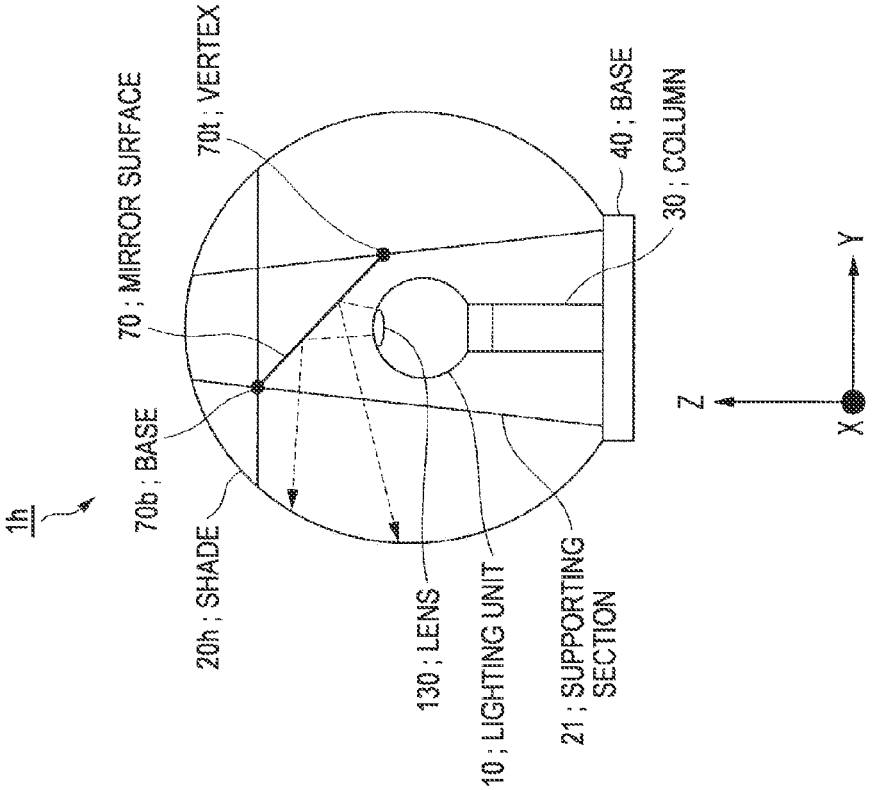


FIG. 12B

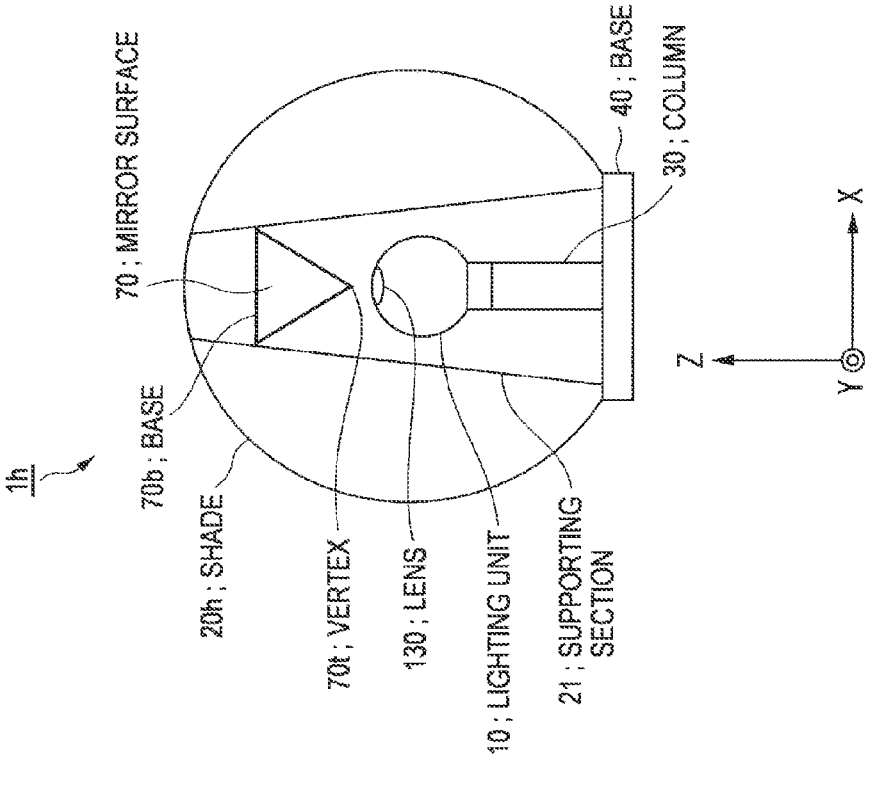


FIG. 12A

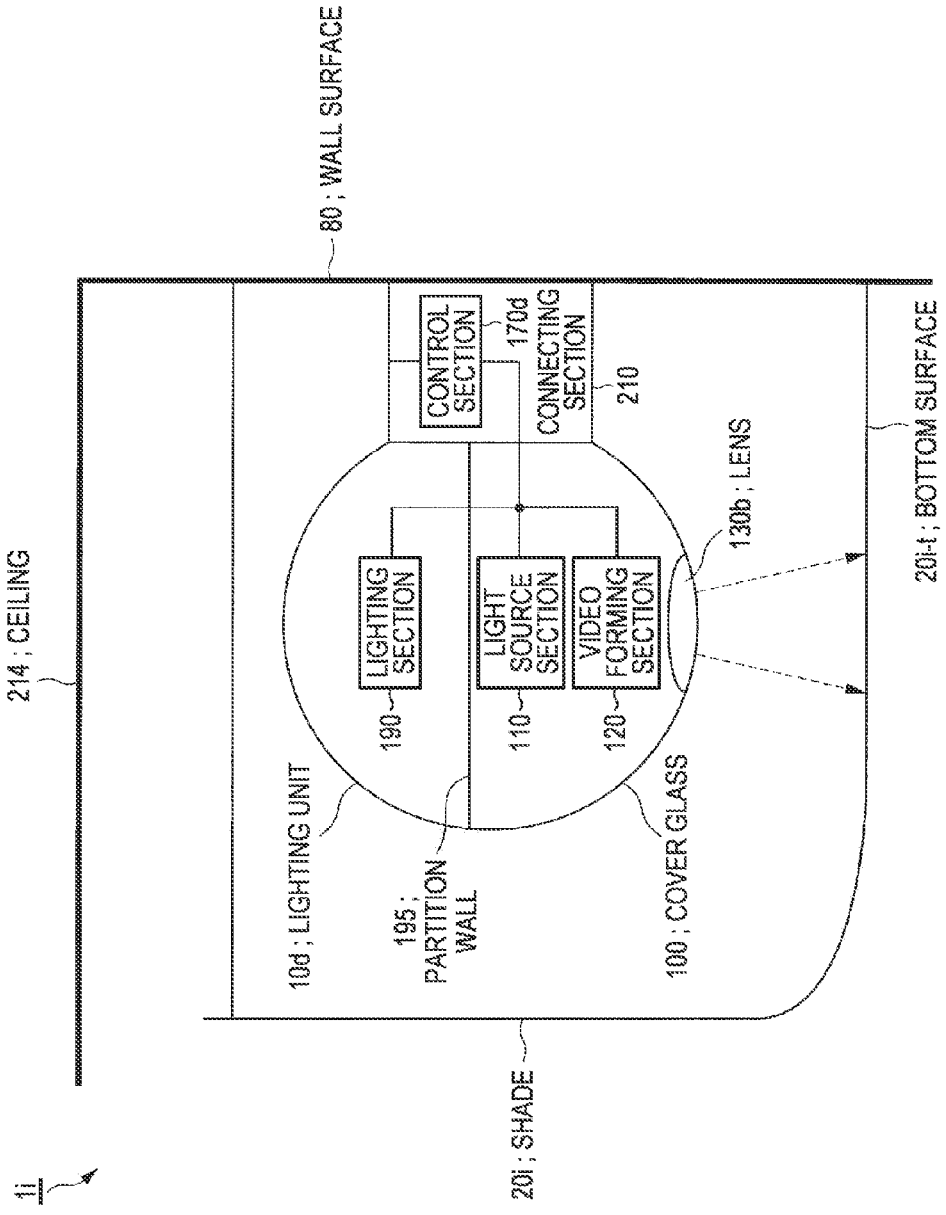

80 ; WALL SURFACE
214 ; CEILING
CONTROL SECTION
170d
CONNECTING SECTION
210
LIGHTING SECTION
190
LIGHT SOURCE SECTION
110
VIDEO FORMING SECTION
120
130b ; LENS
20i-t ; BOTTOM SURFACE
10d ; LIGHTING UNIT
195 ; PARTITION WALL
100 ; COVER GLASS
20i ; SHADE
1i

FIG. 13

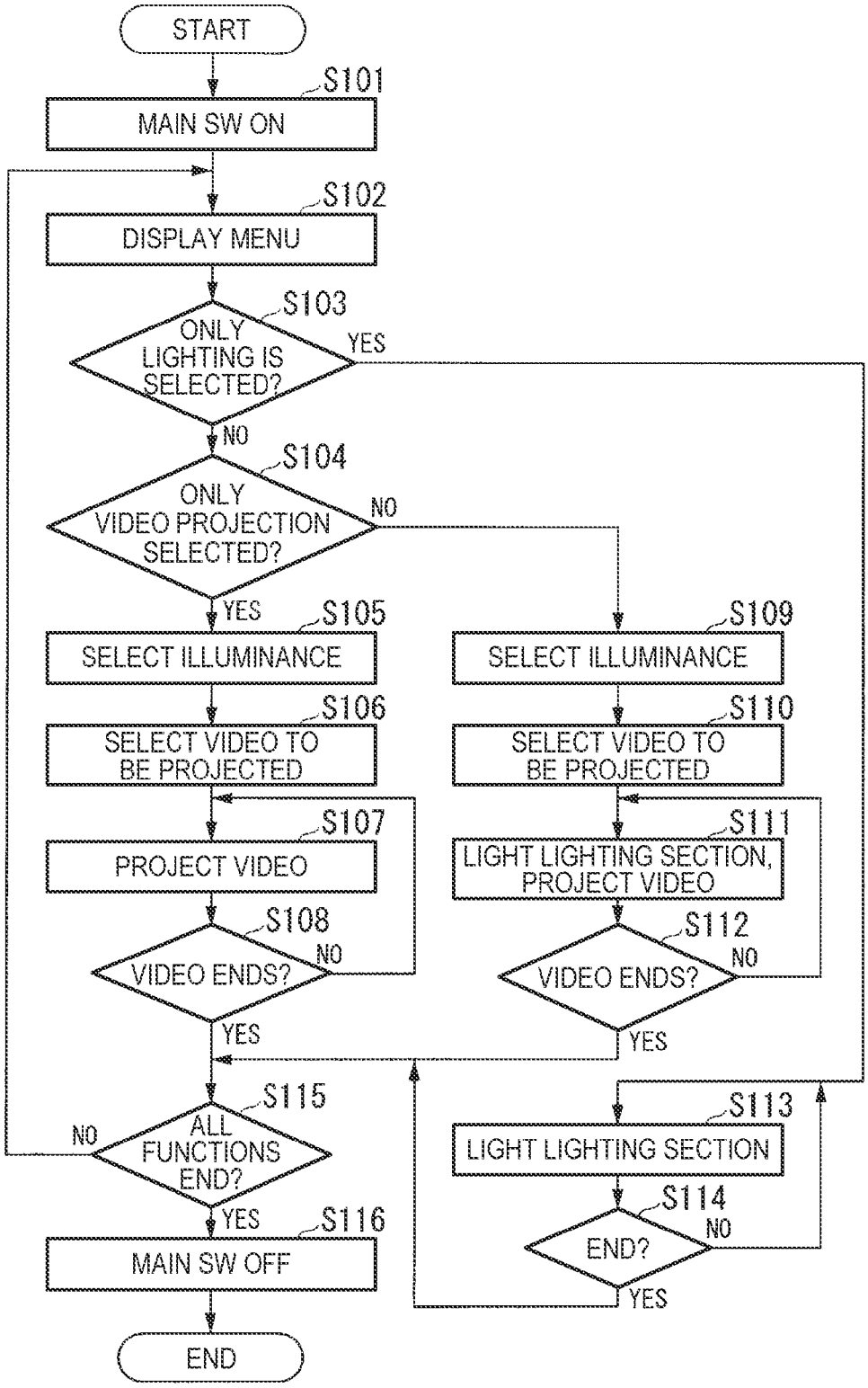

START
S101
MAIN SW ON
S102
DISPLAY MENU
S103
ONLY LIGHTING IS SELECTED?
YES
NO
S104
ONLY VIDEO PROJECTION SELECTED?
NO
YES
S105
SELECT ILLUMINANCE
S106
SELECT VIDEO TO BE PROJECTED
S107
PROJECT VIDEO
S108
VIDEO ENDS?
NO
YES
S109
SELECT ILLUMINANCE
S110
SELECT VIDEO TO BE PROJECTED
S111
LIGHT LIGHTING SECTION, PROJECT VIDEO
S112
VIDEO ENDS?
NO
YES
S113
LIGHT LIGHTING SECTION
S114
END?
NO
YES
S115
ALL FUNCTIONS END?
NO
YES
S116
MAIN SW OFF
END

FIG.14

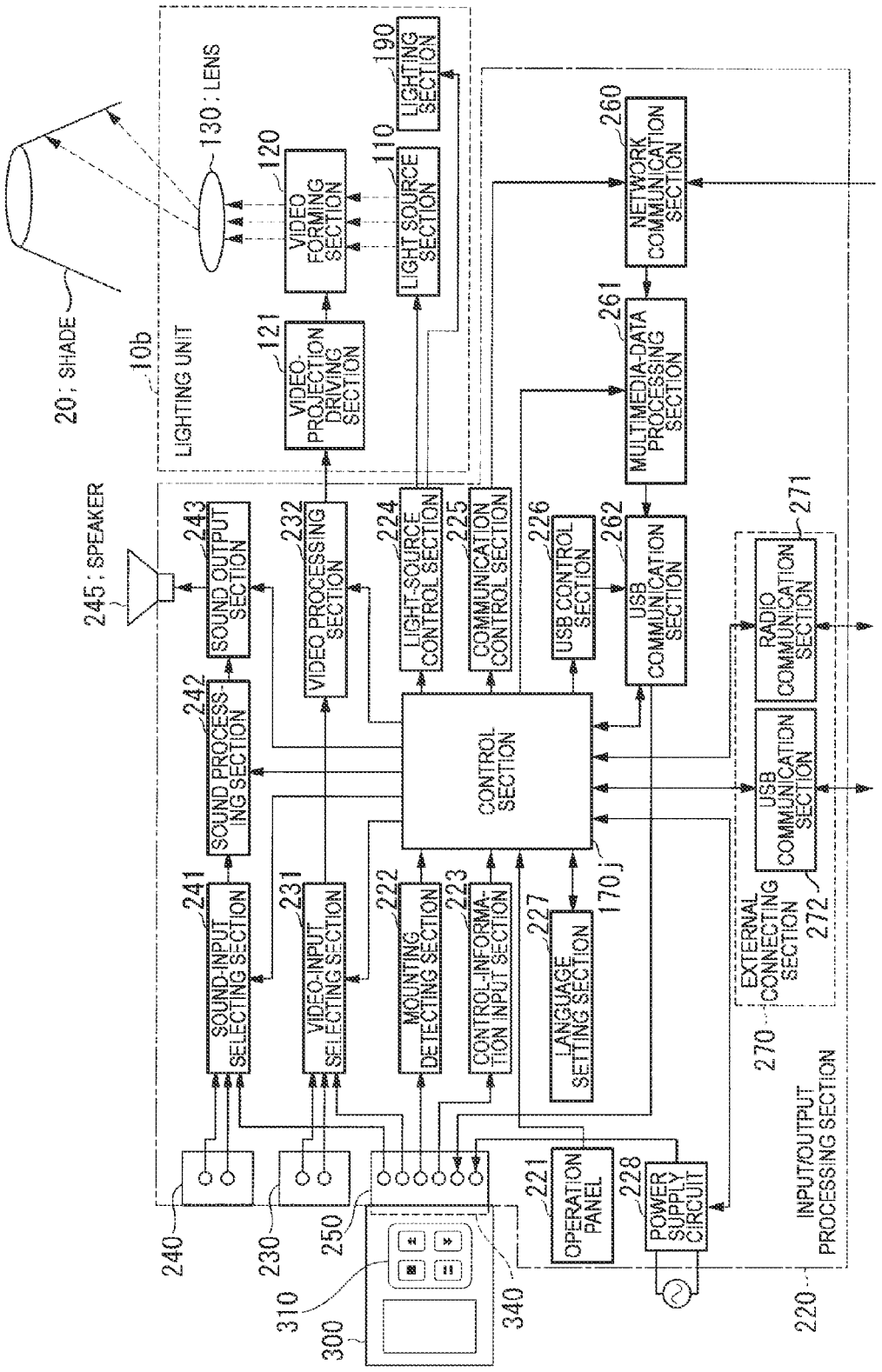

20 ; SHADE
10b
LIGHTING UNIT
130 ; LENS
120
VIDEO FORMING SECTION
110
LIGHT SOURCE SECTION
190
LIGHTING SECTION
121
VIDEO-PROJECTION DRIVING SECTION
260
NETWORK COMMUNICATION SECTION
261
MULTIMEDIA-DATA PROCESSING SECTION
245 ; SPEAKER
243
SOUND OUTPUT SECTION
232
VIDEO PROCESSING SECTION
224
LIGHT-SOURCE CONTROL SECTION
225
COMMUNICATION CONTROL SECTION
226
USB CONTROL SECTION
262
USB COMMUNICATION SECTION
271
RADIO COMMUNICATION SECTION
242
SOUND PROCESSING SECTION
CONTROL SECTION
241
SOUND-INPUT SELECTING SECTION
231
VIDEO-INPUT SELECTING SECTION
222
MOUNTING DETECTING SECTION
223
CONTROL-INFORMATION INPUT SECTION
227
LANGUAGE SETTING SECTION
170 j
USB COMMUNICATION SECTION
EXTERNAL CONNECTING SECTION
272
270
240
230
250
310
300
340
221
OPERATION PANEL
228
POWER SUPPLY CIRCUIT
INPUT/OUTPUT PROCESSING SECTION
220

FIG. 15

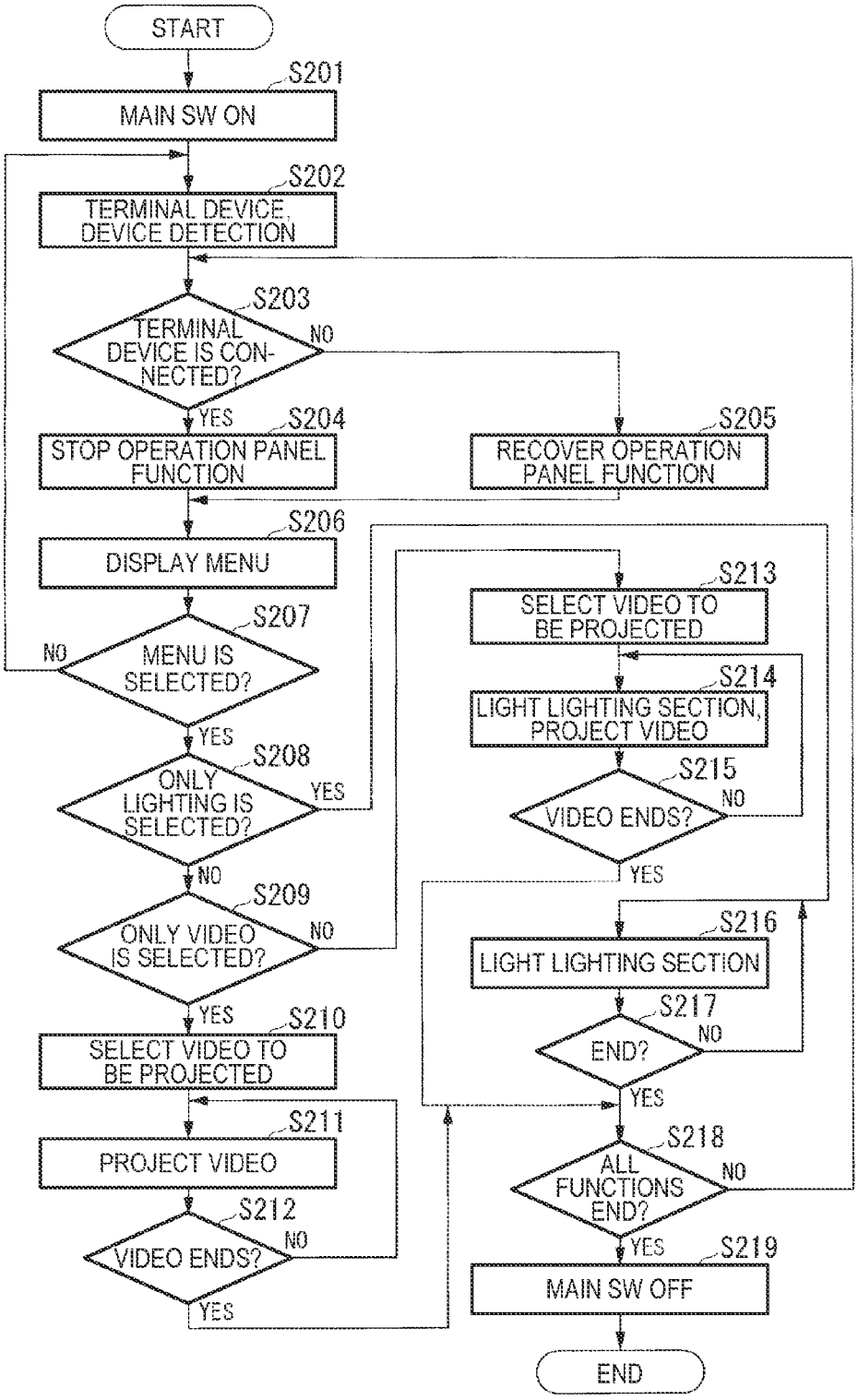

START
S201
MAIN SW ON
S202
TERMINAL DEVICE, DEVICE DETECTION
S203
TERMINAL DEVICE IS CONNECTED?
NO
YES
S204
STOP OPERATION PANEL FUNCTION
S205
RECOVER OPERATION PANEL FUNCTION
S206
DISPLAY MENU
S207
MENU IS SELECTED?
NO
YES
S208
ONLY LIGHTING IS SELECTED?
YES
NO
S209
ONLY VIDEO IS SELECTED?
NO
YES
S210
SELECT VIDEO TO BE PROJECTED
S211
PROJECT VIDEO
S212
VIDEO ENDS?
NO
YES
S213
SELECT VIDEO TO BE PROJECTED
S214
LIGHT LIGHTING SECTION, PROJECT VIDEO
S215
VIDEO ENDS?
NO
YES
S216
LIGHT LIGHTING SECTION
S217
END?
NO
YES
S218
ALL FUNCTIONS END?
NO
YES
S219
MAIN SW OFF
END

FIG.16

LIGHTING DEVICE

The entire disclosure of Japanese Patent Application No. 2012-178146, filed Aug. 10, 2012 is expressly incorporated by reference herein.

BACKGROUND

1. Technical Field

The present invention relates to a lighting device having a lighting function and a video displaying function.

2. Related Art

There has been known a lighting device that reflects a pattern. For example, a lighting device for decoration described in JP-A-2006-302727 (Patent Literature 1) includes an imaging body having optical transparency and provided with a pattern for imaging on a curved surface, a light source configured to obliquely irradiate light toward the imaging body, and a cover provided with an opening section through which the light irradiated from the light source and transmitted through the imaging body is transmitted toward a shadow picture projection surface.

However, in the lighting device for decoration described in Patent Literature 1, to change a video to be projected, it is necessary to replace the imaging body provided with the pattern. The imaging body has to be formed of a material having optical transparency and affixed with a pattern in advance. Therefore, it is difficult to prepare imaging bodies having a variety of patterns beforehand.

SUMMARY

An advantage of some aspects of the invention is to provide a lighting device that can easily display a variety of videos.

An aspect of the invention is directed to a lighting device including: a lighting unit; and an enclosure configured to cover a part or all of the periphery of the lighting unit and transmit light from the lighting unit. The lighting unit includes: a light source section for lighting configured to radiate light; and a video forming section configured to form video light obtained by modulating, on the basis of video information, light from a light source section for video formation configured integrally with or separately from the light source section for lighting and project the video light on the enclosure.

With this configuration, the lighting unit radiates light for lighting from the light source section and projects video light based on an input video signal on the enclosure. Therefore, a user inputs a video signal and a video based on the input video signal is reflected on the enclosure. The user can easily display a variety of videos by visually recognizing the video reflected on the enclosure.

Another aspect of the invention is directed to the light device, wherein the lighting unit further includes: a light transmitting section provided in a position where the video light from the video forming section is irradiated, a transparent state and a non-transparent state of the light transmitting section being switched according to presence or absence of application of a voltage; and a control section configured to control the voltage applied to the light transmitting section according to presence or absence of projection of the video light from the video forming section. With this configuration, whereas the light for lighting is scattered and radiated, the video is clearly reflected on the enclosure. Therefore, visibility of the video is improved even when the light is used for lighting.

Still another aspect of the invention is directed to the lighting device, wherein the lighting unit further includes a projecting-direction converting section configured to change a direction of the video light projected by the video forming section and project the video light on the enclosure. With this configuration, limitation on a positional relation between the lighting unit and the enclosure is relaxed and a degree of freedom of design of the lighting device is improved.

Yet another aspect of the invention is directed to the lighting device, wherein the light source section for lighting and the light source section for video formation are configured separately, and the lighting unit includes a partition wall section configured to partition a first space in which the light source section for video formation and the video forming section are housed and a second space in which the light source section for lighting is housed. With this configuration, a function for lighting and a function for forming a video work independently from each other. Further, since light radiated as a video is clearly reflected without mixing in light radiated as lighting, visibility of the video is improved.

Still yet another aspect of the invention is directed to the lighting device, wherein the video forming section projects the video light in a direction different from a direction of light radiated as lighting by the light source section for lighting. With this configuration, since a region where the light projected as the video is reflected on the enclosure and a region where the light is reflected on the enclosure as lighting are different, visibility of the video is improved.

Further another aspect of the invention is directed to the lighting device, wherein the lighting device further includes a control section configured to switch lighting or extinguishing of the light source section for lighting or a video signal supplied to the video forming section. With this configuration, since a unit allowing the user to switch presence or absence of radiation of light and a video signal to be supplied is given to the user, convenience is improved.

Still further another aspect of the invention is directed to the lighting device, wherein the lighting device further includes a housing section configured to detachably house a communication device that accumulates a video signal, and the control section switches whether the video signal is output from the communication device to the video forming section. With this configuration, since the user can select the video signal accumulated by the communication device, convenience is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIGS. **1**A and **1**B are external views showing an external appearance of a lighting device according to a first embodiment of the invention.

FIG. **2** is a schematic diagram showing a configuration example of a lighting unit according to the embodiment.

FIG. **3** is a schematic diagram showing the configuration of a light source section according to the embodiment.

FIG. **4** is a schematic diagram showing another configuration example of the lighting unit according to the embodiment.

FIG. **5** is a schematic diagram showing still another configuration example of the lighting unit according to the embodiment.

FIGS. **6**A and **6**B are schematic diagrams showing a setting example of the lighting unit according to the embodiment.

FIG. **7** is a schematic diagram showing still another configuration example of the lighting unit according to the embodiment.

FIG. **8** is a schematic diagram showing still another configuration example of the lighting unit according to the embodiment.

FIG. **9** is a schematic diagram showing still another configuration example of the lighting unit according to the embodiment.

FIG. **10** is a sectional view showing the configuration of the lighting device according to the embodiment.

FIG. **11** is a top view showing the configuration of the lighting device according to the embodiment.

FIGS. **12**A and **12**B are schematic diagrams showing the configuration of the lighting device according to the embodiment.

FIG. **13** is a schematic diagram showing the configuration of the lighting device according to the embodiment.

FIG. **14** is a flowchart for explaining processing related to control of a lighting function and a video displaying function according to the embodiment.

FIG. **15** is a schematic diagram showing the configuration of a lighting device according to a second embodiment of the invention.

FIG. **16** is a flowchart for explaining processing related to control of a lighting function and a video displaying function according to the invention.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

First Embodiment

An embodiment of the invention is explained below with reference to the accompanying drawings.

FIGS. **1**A and **1**B are external views showing an external appearance of a lighting device **1** according to this embodiment.

The lighting device **1** includes a lighting unit **10**, a shade (an enclosure) **20**, a column **30**, a base **40**, an operation input section **50**, and a video input section **60**.

FIG. **1**A is a perspective view showing a side of the lighting device **1**.

The shade **20** has, for example, a cylindrical shape. The upper surface of the shade **20** is opened and the side surface of the shade **20** surrounds the lighting unit **10**. The shade **20** transmits parts of light and a video radiated by the lighting unit **10** set on the inside of the shade **20**. The material of the shade **20** is not always limited to a transparent material (e.g., polyester) and may be a semitransparent material or may be a material in which fine light transmitting holes are dispersed (e.g., paper or cloth).

The column **30** has, for example, an elongated cylindrical shape. The lower end of the column **30** is supported by the base **40**. The column **30** supports the shade **20** on the side surface of the column **30** and supports the lighting unit **10** at the upper end of the column **30**. The column **30** supplies a video signal and electric power input from the video input section **60** to the lighting unit **10**. The radius of the column **30** is smaller than the shade **20**.

The base **40** has, for example, a disc shape. The base **40** supports the lower end of the column **30** in the center of the upper surface of the base **40**. The base **40** includes the operation input section **50** and the video input section **60** respectively on surfaces of the base **40**, for example, the upper surface and the side surface.

The operation input section **50** includes a main switch, other switches, and the like operated by a user. For example, the operation input section **50** receives an operation input by the user through the main switch and outputs a signal for switching presence or absence of the supply of electric power from the outside to the lighting unit **10** on the basis of the received operation input to a power supply circuit (not shown in the figure) via a control section (explained below). The power supply circuit includes a switch circuit configured to turn on and off the supply of the electric power. For example, when changed to a closed state according to the operation input, the switch circuit supplies the electric power to the lighting unit **10**. When changed to an open state according to the operation input, the switch circuit stops the supply of the electric power. The operation input section **50** outputs a video signal supply control signal corresponding to the operation input to the control section (explained below). The video signal supply control signal is a signal indicating control of presence or absence of the supply of a video signal input from the video input section **60** and selection of any one kind of video signal among a plurality of video signals. As another example, the operation input section **50** may output an operation input signal indicating the received operation input to the lighting unit **10**.

The video input section **60** receives a video signal from the outside and outputs the input video signal to the control section. The video input section **60** is, for example, a video input terminal (port).

FIG. **1**B is a sectional view showing the left-right cross section of the lighting device **1**. FIG. **1**B indicates that the center point of the lighting unit **10** is arranged at the center point of the shade **20**.

The lighting unit **10** radiates light and a video toward the inner surface of the shade **20**. The side surface of the shade **20** transmits the light radiated by the lighting unit **10** and displays the video projected by the lighting unit **10** on the outside from the side surface. The light radiated by the lighting unit **10** is radiated to the outside from the top of the shade **20** as well.

Configuration Example of the Lighting Unit

A configuration example of the lighting unit **10** according to this embodiment is explained.

FIG. **2** is a schematic diagram showing a configuration example of the lighting unit **10** according to this embodiment.

The lighting unit **10** configures an optical system of the lighting device **1**. The lighting unit **10** includes a cover glass **100**, a light source section **110**, a video forming section **120**, a lens **130**, a distance measuring section **140**, an image pickup section **150**, two electrodes **160-1** and **160-2**, a control section **170**, and a connecting section **210**.

The cover glass **100** has a substantially spherical shape. One end of the cover glass **100** is sealed by the connecting section **210**. The light source section **110**, the video forming section **120**, the lens **130**, the distance measuring section **140**, the image pickup section **150**, the electrodes **160-1** and **160-2**, and the control section **170** are housed on the inside of the cover glass **100** and covered by the cover glass **100**. The cover glass **100** radiates light radiated by the light source section **110**.

The light source section **110** receives the supply of electric power via the connecting section **210**, emits light to the video forming section **120**, and radiates the light to the cover glass **100**. That is, the light source section **110** is a light source for lighting in the lighting unit **10**. The light source

section **110** also functions as a light source for video formation of video light projected by the video forming section **120**. That is, in this example, in the light source section **110**, the light source for lighting and the light source for video formation are integrally configured. The configuration of the light source section **110** is explained below.

The video forming section **120** modulates light made incident from the light source section **110** according to a video signal input from the control section **170** to form video light representing a video and emits the formed video light to the lens **130**. The video forming section **120** includes, for example, a liquid crystal light modulating element configured to emit full-color video light. When a video signal is not input from the control section **170** and light is made incident from the light source section **110**, the incident light is emitted to the lens **130** without being modulated (e.g., while being kept as white light).

The video forming section **120** may include a color filter (not shown in the figure). The color filter is configured by, for example, a Bayer-array color filter including a reflective dichroic filter. The color filter has a function of a color separation optical system that separates light made incident from the light source section **110** into red light, green light, and blue light for each of pixels. In this embodiment, the color separation optical system is not limited to an RGB colorimetric system including three colors of red, green, and blue. Other color separation optical systems, for example, a YMC colorimetric system may be used.

The video forming section **120** may include sheet polarizers (not shown in the figure), polarization directions of which are orthogonal to each other on both of a surface on which light is made incident from the light source section **110** and a surface from which video light for each of the colors is emitted. It is possible to extract a component of each of the colors, perform light modulation for the extracted components of each of the colors, and emit video light.

The lens **130** transmits image light made incident from the video forming section **120**. The lens **130** is arranged such that the lens **130** is focused on the inner surface of the shade **20**, which is a projection surface, and the direction of the optical axis of the lens **130** is substantially perpendicular to the inner surface of the shade **20**. The thickness of the lens **130** is variable based on the voltage between the electrodes **160-1** and **160-2** provided at both ends of the lens **130**. As explained below, a focal length of the lens **130** may be adjusted to a distance measured by the distance measuring section **140** as explained below. Consequently, even if the distance between the lens **130** and the shade **20** is variable, it is possible to adjust the focal length (focus adjustment) and enlarge and project a video formed on the projection surface by the video forming section **120**.

When the distance between the lens **130** and the shade **20** is fixed, the thickness of the lens **130** may be set in advance such that a focal length corresponding to the distance between the lens **130** and the shade **20** is obtained. In that case, processing for setting the voltage between the electrodes **160-1** and **160-2** can be omitted.

The distance measuring section **140** measures a distance to the projection surface and outputs distance data indicating the measured distance to the control section **170**. A direction in which the distance measuring section **140** measures the distance is a direction same as the direction of the optical axis of the lens **130**. The distance measuring section **140** is, for example, an infrared laser distance meter that uses an electromagnetic wave in a band (an infrared ray, etc.) other than a visible ray.

When an operation input signal input from the operation input section **50** via the control section **170** is a signal indicating photographing of a video, the image pickup section **150** photographs a video in the optical axis direction and outputs a photographed video signal indicating the photographed video to the control section **170**. The direction of the optical axis of the image pickup section **150** is a direction same as the optical axis direction of the lens **130**. The image pickup section **150** is, for example, a CCD image sensor (Charge Coupled Device Image Sensor). In this embodiment, the image pickup section **150** may be omitted.

The electrodes **160-1** and **160-2** are set at one end of the lens **130** and the other end opposed to the one end. A voltage is applied from the control section **170** between the ends. Consequently, the thickness of the lens **130** is changed to adjust the focal length.

The control section **170** outputs a video signal input from the video input section **60** via the connecting section **210** to the video forming section **120**. When a photographed video signal is input from the image pickup section **150**, the control section **170** may output the input photographed video signal to the video forming section **120** and project a video based on the photographed video signal.

The control section **170** controls, on the basis of a video signal supply control signal input from the operation input section **50**, whether the video signal input from the video input section **60** is output (supplied) to the video forming section **120**. When a plurality of video signals are input to the control section **170**, the control section **170** selects, on the basis of the input video signal supply control signal, a video signal to be output to the video forming section **120**.

The control section **170** sets, on the basis of a distance indicated by distance data input from the distance measuring section **140**, a value of a voltage (a voltage value) applied between the electrodes **160-1** and **160-2**. For example, voltage control data indicating a correspondence relation between distances and voltage values is stored in the control section **170** in advance. The control section **170** sets a voltage value corresponding to a distance indicated by input distance data. The control section **170** applies the voltage of the set voltage value between the electrodes **160-1** and **160-2**.

In this embodiment, the control section **170** does not always have to be included in the lighting unit **10** and may be included in a main body section such as the column **30** or the base **40**. For example, the control section **170** may be integrated with the operation input section **50** or the video input section **60**.

The connecting section **210** is connected to the upper end of the column **30**. The connecting section **210** supplies supplied electric power to the light source section **110** and outputs a video signal input from the video input section **60** to the video forming section **120**. An external appearance and a function (for supplying supplied electric power to the light source section) of the connecting section **210** may be the same as those of a connecting section provided at the end of an incandescent light bulb, a bulb-type fluorescent lamp, or a bulb-type LED lamp in the past. The example shown in FIG. **2** is a configuration for screwing and connecting the entire lighting unit **10** to the upper end of the column **30** while rotating the lighting unit **10**.

In this embodiment, the connecting section **210** may be omitted. The other components of the lighting unit **10** may be directly connected to the column **30**.

With the configuration explained above, light generated by supplied electric power is modulated by an input video signal to form an image. The formed image is projected on

the shade **20**. The user can visually recognize the projected image. Consequently, by changing a video signal to be input, it is possible to change a video signal to be projected. Therefore, a lighting device that can easily display a variety of videos is provided.

Example of the Configuration of the Light Source Section

The configuration of the light source section **110** according to this embodiment is explained.

FIG. **3** is a schematic diagram showing the configuration of the light source section **110** according to this embodiment.

The light source section **110** includes a luminous body **111**, a collimator optical system **112**, and a polarization conversion element **113**. An optical axis **114** of these components is arranged on a straight line same as the optical axis of the video forming section **120** and the optical axis of the lens **130**.

The luminous body **111** emits light to the collimator optical system **112** with supplied electric power. The luminous body **111** is, for example, a white light emitting diode that emits white light including components of red light, green light, and blue light.

The collimator optical system **112** is an optical element that parallelizes light made incident from the luminous body **111** and emits the parallelized light to the polarization conversion element **113**.

The polarization conversion element **113** subjects light made incident from the collimator optical system **112** to polarization conversion and emits the light subjected to the polarization conversion to the video forming section **120**. The polarization conversion element **113** includes a polarization separation layer that transmits one linearly polarized light component in the incident light and reflects the other linearly polarized light component in a direction perpendicular to the optical axis **114**, a reflection layer that reflects the other linearly polarized light component, which is reflected by the polarization separation layer, in a direction parallel to the optical axis **114**, and a phase difference plate that converts the other linearly polarized light component, which is reflected by the reflection layer, into a polarized light component same as the one linearly polarized light component.

In this embodiment, a digital mirror device (DMD) may be used as the video forming section **120**. The DMD reflects light from the light source section **110** and guides light formed as video light to the lens **130**. Therefore, unlike the example shown in FIG. **3**, the optical axis **114** of the light source section **110** is not on a straight line same as the optical axis of the video forming section **120** and the lens **130**. The DMD is a display element in which a large number of micro-mirrors are arrayed on a plane. The micro-mirrors are controlled whether to reflect the light from the light source section **110** or not according to whether a voltage is applied to the micro-mirrors. Light and shade of a video are represented by changing a control time interval of the voltage in the micro-mirrors and a ratio of time when the voltage is applied and time when the voltage is not applied. A color video is represented by transmitting input light through a rotary color filter that transmits any one color component among a plurality of color components included in the input light and switching a color at a frequency higher than a frame frequency.

Another Configuration Example "a" of the Lighting Unit

As another configuration example "a" of the lighting unit **10**, a lighting unit **10***a* is explained. In the lighting unit **10***a*, components same as those in the lighting unit **10** are denoted by the same reference numerals and signs.

FIG. **4** is a schematic diagram showing another configuration example "a" of the lighting unit according to this embodiment (the lighting unit **10***a*).

The lighting unit **10***a* includes a sound output section **180** in addition to the components included in the lighting unit **10** and includes a control section **170***a* instead of the control section **170**.

The control section **170***a* performs processing same as the processing by the control section **170**. Besides, when a sound signal is included in a video signal input from the video input section **60**, the control section **170***a* extracts the sound signal from the video signal and outputs the extracted sound signal to the sound output section **180**. When the lighting device **1** includes a sound input section (not shown in the figure) to which a sound signal is input, the control section **170***a* may output the sound signal input from the sound input section to the sound output section **180**. In that case, the control section **170***a* may switch presence or absence of the supply of the sound signal in association with presence or absence of the supply of the video signal.

The sound output section **180** reproduces sound based on the sound signal input from the control section **170***a*. The sound output section **180** is, for example, an electrostriction speaker that changes in a shape according to an input voltage to thereby generate vibration.

Consequently, since sound based on the input sound signal is reproduced in association with a projected video, it is possible to increase the interest of the user.

Another Configuration Example "b" of the Lighting Unit

As another configuration example "b" of the lighting unit **10**, a lighting unit **10***b* is explained. In the lighting unit **10***b*, components same as those in the lighting unit **10** are denoted by the same reference numerals and signs.

FIG. **5** is a schematic diagram showing another configuration example "b" of the lighting unit according to this embodiment (the lighting unit **10***b*).

The lighting unit **10***b* includes a control section **170***b* instead of the control section **170** and includes a lighting section (a light source section for lighting) **190** separately from the light source section (a light source section for video projection) **110**. Consequently, it is possible to independently control lighting or extinguishing of a light and display or non-display of a video. The light source section **110** is integrated with the video forming section **120** and is not shown in FIG. **5**.

The control section **170***b* performs processing same as the processing by the control section **170**.

A broken line on the right side in the cover glass **100** shown in FIG. **5** indicates a lens **130***b*, which is another arrangement example of the lens **130**. In this example, the lens **130** may be omitted and the video forming section **120** may project a video to the right. The projected video is transmitted through the lens **130***b* and projected on the inner surface of the shade **20**. Therefore, the video forming section **120** may be arranged with the direction of the optical axis set to the right. Alternatively, a mirror surface (not shown in the figure) for reflecting the projected video may be provided on the front surface of a projection port for the video to change the direction of the video from the downward direction to the right direction while the direction of the optical axis is kept downward. When the distal end of the lighting unit **10***b* is faced up and fixed as in the lighting unit **10** shown in FIG. **1**B, the lighting device **1** can display an image on the side of the shade **20**.

FIGS. **6**A and **6**B are schematic diagrams showing a setting example of the lighting unit **10***b* according to this embodiment.

In FIGS. **6**A and **6**B, the lighting unit **10***b* includes a connecting section **210***b* instead of the connecting section **210**. The lighting unit **10***b* is suspended from, for example, an indoor ceiling **214**. The connecting section **210***b* is connected to one end of an elongated cylindrical suspension fixture **211**. The other end of the suspension fixture **211** seals one end of the cover glass **100**.

FIG. **6**A shows a state in which the lighting unit **10***b* according to this embodiment is not attached to the ceiling **214**.

Fixtures **212** to be engaged with a fixing section **213***b* are provided on the upper surface of the connecting section **210***b*.

Holes with which the fixtures **212** are engaged are provided on the bottom surface of the fixing section **213***b*. The upper surface of the fixing section **213***b* adheres to the ceiling **214**.

FIG. **6**B shows a state in which the lighting unit **10***b* according to this embodiment is attached to the ceiling **214**.

The connecting section **210***b* and the fixing section **213***b* are connected via the fixtures **212**. The fixtures **212** are formed of a material having rigidity and electrical conductivity, for example, metal. Consequently, electric power and a video signal are supplied to the lighting unit **10***b* from the outside via the fixtures **212** engaged with the fixing section **213***b*. In that case, for example, a conductor wire (not shown in the figure) for transmitting the electric power and the video signal between the operation input section **50** and the video input section **60** and between the operation input section **50** and the fixing section **213***b* may be provided on the wall surface. The shade **20** (not shown in the figure) may be connected to the ceiling **214** to surround the lighting unit **10***b* to display a video on the side surface or the bottom surface of the shade **20**. A material (e.g., frosted glass) having light scattering properties higher than the light scattering properties of a transparent material and having transmittance lower than the transmittance of the transparent material may be used as the material of the cover glass **100** and caused to function as the shade **20**.

Another Configuration Example "c" of the Lighting Unit

As another configuration example "c" of the lighting unit **10**, a lighting unit **10***c* is explained. In the lighting unit **10***c*, components same as those in the lighting unit **10** are denoted by the same reference numerals and signs.

FIG. **7** is a schematic diagram showing another configuration example "c" of the lighting unit according to this embodiment (the lighting unit **10***c*).

In the lighting unit **10***c*, the light source section (the light source section for video projection) **110** and the lighting section (the light source section for lighting) **190** of the lighting unit **10***b* are separately configured.

A solid line on the right side of the cover glass **100** shown in FIG. **7** indicates a lens **130***b*, which is another configuration example of the lens **130**. In this case, the lens **130** may be omitted and the video forming section **120** may be configured to project a video on the inner surface of the shade **20** via the lens **130***b*. When the distal end of the lighting unit **10***b* is faced up as shown in FIG. **1**B, the lighting device **1** can display an image on the side of the shade **20**.

Another Configuration Example "d" of the Lighting Unit

As another configuration example "d" of the lighting unit **10**, a lighting unit **10***d* is explained. In the lighting unit **10***d*, components same as those in the lighting unit **10** are denoted by the same reference numerals and signs.

FIG. **8** is a schematic diagram showing another configuration example "d" of the lighting unit according to this embodiment (the lighting unit **10***d*).

The lighting unit **10***d* further includes a partition wall (a partition wall section) **195** in the configuration of the lighting unit **10***c*.

The partition wall **195** partitions the inner space of the cover glass **100** into two spaces. The light source section (the light source section for video formation) **110** and the video forming section **120** are housed in one space (a first space) of the two spaces. The lighting section (the light source section for lighting) **190** are housed in the other space (a second space). That is, the lighting section **190** is configured as a light source separate from the light source section **110**. The partition wall **195** is formed of a material for preventing light by a video projected by the video forming section **120** from leaking to the second space in which the lighting section **190** is housed and preventing light radiated by the lighting section **190** from leaking to the first space in which the light source section **110** and the video forming section **120** are housed. Consequently, since the light radiated by the lighting section **190** is not irradiated on the video projected by the video forming section **120**, the video is clearly displayed. The lighting unit **10***d* can be properly used according to a direction. For example, the lighting unit **10***d* displays a video in one direction and lights the lighting section **190** in the other direction. A configuration example of a lighting device (a lighting device **1***i*) including the lighting unit **10***d* is explained below.

Another Configuration Example "e" of the Lighting Unit

As another configuration example "e" of the lighting unit **10**, a lighting unit **10***e* is explained. In the lighting unit **10***e*, components same as those in the lighting unit **10** are denoted by the same reference numerals and signs.

FIG. **9** is a schematic diagram showing another configuration example "e" of the lighting unit according to this embodiment (the lighting unit **10***e*).

The lighting unit **10***e* includes a cover glass (a light transmitting section) **100***e*, a lens (a light transmitting section) **130***e*, and a control section **170***e* instead of the cover glass **100**, the lens **130**, and the control section **170** in the configuration of the lighting unit **10** and further includes electrodes **160***e*-**1** and **160***e*-**2** and electrodes **161**-**1** and **161**-**2**. A position where the lens **130***e* is provided is closer to the video projection surface of the video forming section **120** than the cover glass **100***e*.

The material of the cover glass **100***e* and the lens **130***e* includes a substance, a refractive index of which changes according to an applied voltage. Examples of such a substance include PDLC (Polymer Dispersed Liquid Crystal). When a voltage is not applied to the PDLC, the PDLC is clouded, that is, light scatters on the surface of the PDLC and the PDLC is visually recognized as opaque white because the refractive index is higher than the refractive index of the atmosphere. On the other hand, when a voltage is applied to the PDLC, since the refractive index is substantially equal to the refractive index of the atmosphere, light does not scatter on the surface of the PDLC and the PDLC is visually recognized as transparent. That is, the cover glass **100***e* and the lens **130***e* are provided in positions where a video from the video forming section **120** is irradiated. Transparent and non-transparent states of the cover glass **100***e* and the lens **130***e* are switched according to presence or absence of application of a voltage. A degree of the cloudiness changes according to not only the refractive index but also the applied voltage.

The electrode **160***e*-**1** is provided at one end of the lens **130***e* and the electrode **160***e*-**2** is provided at the other end of the lens **130***e*. The electrode **161-1** is provided in one region of the cover glass **100***e* and the electrode **161-2** is provided in the other region of the cover glass **100***e*.

The control section **170***e* performs processing same as the processing by the control section **170**. Beside, when a video signal is input from the video input section **60**, the control section **170***e* applies a voltage between the electrodes **160***e*-**1** and **160***e*-**2** and applies a voltage between the electrodes **161-1** and **161-2** to thereby make the lens **130***e* and the cover glass **100***e* transparent.

When the input of the video signal from the video input section **60** is stopped, the control section **170***e* stops the application of the voltage between the electrodes **160***e*-**1** and **160***e*-**2** and stops the application of the voltage between the electrodes **161-1** and **161-2** to thereby cloud the lens **130***e* and the cover glass **100***e*.

When the lighting unit **10***e* is caused to function for radiation of light, that is, lighting, the cover glass **100***e* and the lens **130***e* are clouded. Light radiated by the light source section **110** scatters in the lens **130***e* and the cover glass **100***e*. Deviation does not occur in illuminance in each of radiating directions. Therefore, it is possible to prevent a phenomenon in which illuminance in a specific radiating direction is higher than illuminance in the other radiating directions (so-called hot spot, LED eye-ball, etc.).

On the other hand, when the lighting unit **10***e* projects a video, since the cover glass **100***e* and the lens **130***e* are transparent, it is possible to project the video without losing sharpness of the video.

In the above explanation, the lens **130***e* and the cover glass **100***e* are switched to be transparent or cloudy and timings for the switching are the same. However, this modification is not limited to this. For example, only one of the lens **130***e* and the cover glass **100***e* may be switched to be transparent or cloudy. When electric power is supplied to the light source section **110** and a video signal is not output to the video forming section **120**, the control section **170***e* may control, on the basis of an operation input signal input from the operation input section **50**, whether a voltage is applied between the electrodes **161-1** to **161-2**. However, electric power is not supplied to the lens **130***e*. It is possible to perform control to scatter light in a part of a region by clouding the cover glass **100***e* and the lens **130***e*, scattering light in the entire space, or clouding the cover glass **100***e* and keeping only the lens **130***e* clouded. Besides, the control section **170***e* can continuously change the voltage between the electrodes **161-1** and **161-2** on the basis of an operation signal and change a degree of cloudiness of the cover glass **100***e*, that is, a degree of scattering of light.

As explained above, in this modification, it is possible to increase interest by adjusting a degree of scattering of light used for lighting and presence or absence of scattering to a part of regions while realizing both the functions of the lighting and the video display.

Another configuration example "f" of the lighting device

Another configuration example "f" of the lighting device **1** (a lighting device **1***f*) is explained. In the lighting device **1***f*, components same as those in the lighting device **1** are denoted by the same reference numerals and signs.

FIG. **10** is a sectional view showing the configuration of the lighting device **1***f* according to this embodiment.

The lighting device **1***f* includes the lighting unit **10***c*, a shade **20***f*, and the suspension fixture **211**. The configuration of the lighting device **1***f* is the same as the configuration of the lighting device **1** except that the shade **20***f* is different from the shade **20** (FIGS. **1**A and **1**B) in a shape and the arrangement of the lighting unit **10***c* provided instead of the lighting unit **10** is different.

The shade **20***f* has a substantially circular truncated cone shape. The center point of the lighting unit **10***c* is located at the center point of the shade **20***f*. The shade **20***f* is arranged to surround the entire lighting unit **10***c*. Light radiated from the lighting unit **10***c* is radiated in all directions. A part of the light is transmitted through the shade **20***f*. On the other hand, a video (indicated by broken lines) projected from the lighting unit **10***c* is projected substantially perpendicularly to the inside of the side surface of the shade **20***f*. The video is displayed on the outside of the shade **20***f*. Consequently, the user can visually recognize the video reflected on the side surface of the shade **20***f*.

Another configuration example "g" of the lighting device

Another configuration example "g" of the lighting device **1** (a lighting device **1***g*) is explained. In the lighting device **1***g*, components same as those in the lighting device **1** are denoted by the same reference numerals and signs. The lighting device **1***g* is an example including a plurality of lighting units **10** each including the light source section **110** and the video forming section **120**. In this example, the number of lighting units **10** is two. Reference signs **10-1** and **10-2** are respectively affixed to the two lighting units to distinguish the lighting units.

FIG. **11** is a top view showing the configuration of the lighting device **1***g* according to this embodiment.

FIG. **11** shows a view equivalent to a surface of the lighting device **1** shown in FIGS. **1**A and **1**B overlooked from above.

The lighting device **1***g* includes lighting units **10-1** and **10-2** and a shade **20***g* instead of the lighting unit **10** and the shade **20** of the lighting device **1** (FIGS. **1**A and **1**B) and further includes attaching sections **301-1** and **301-2**.

The lighting units **10-1** and **10-2** respectively radiate videos (indicated by broken lines) in opposite directions. The lighting units **10-1** and **10-2** are set in a direction parallel to the horizontal plane. The lighting units **10-1** and **10-2** are fixed to the upper end of the column **30** respectively by the attaching sections **301-1** and **301-2**. The shade **20***g* has a substantially cylindrical shape. In this modification, the side surface of the shade **20***g* may have a bellows-like surface, the radius of which periodically changes, instead of a smooth surface, the radius of which is substantially fixed in the circumferential direction.

The shade **20***g* is arranged such that the center point of both the lighting units **10-1** and **10-2** is located at the center point of the shade **20***g* and the shade **20***g* surrounds the entire lighting units **10-1** and **10-2**. Lights radiated from the lighting units **10-1** and **10-2** are made incident on the inside of the side surface of the shade **20***g* and radiated to the outside. Consequently, videos projected by the lighting units **10-1** and **10-2** are visually recognized respectively in different directions from the outside of the lighting device **1***g*.

Video signals in two or more systems may be input to the video input section **60**. Control sections respectively included in the lighting units **10-1** and **10-2** may be configured to select any one or two systems among the input video signals.

The operation input section **50** may be configured to receive an operation input indicating which light of the lighting units **10-1** and **10-2** is lit. Electric power may be supplied to the lighting unit **10-1** or **10-2** to be lit.

In the example explained above, the lighting device **1***g* includes the two lighting units **10-1** and the like. However,

this modification is not limited to this. The lighting device **1***g* may include more than two (e.g., three) lighting units **10-1** and the like.

The lighting device **1***g* may include a plurality of lighting units **10-1** and the like. Besides, one lighting unit **10** may include a plurality of video forming sections **120**. The video forming sections **120** may be set to radiate videos respectively in different directions.

Consequently, in this modification, a plurality of videos are respectively displayed in different directions. For example, one user can simultaneously visually recognize the plurality of videos. A plurality of users can respectively visually recognize desired videos.

Another Configuration Example "h" of the Lighting Device

A lighting device **1***h*, which is another configuration example of the lighting device **1**, is explained. In the lighting device **1***h*, components same as the components of the lighting device **1** are denoted by the same reference numerals and signs.

FIGS. **12**A and **12**B are schematic diagrams showing the configuration of the lighting device **1***h* according to this embodiment.

The lighting device **1***h* includes a shade **20***h* instead of the shade **20** of the lighting device **1** (FIGS. **1**A and **1**B) and further includes a supporting section **21** and a mirror surface **70** as a projecting-direction converting section.

FIG. **12**A is a perspective view of the lighting device **1***h* according to this embodiment.

In FIG. **12**A, a Z direction indicates a direction of the height of the lighting device **1***h*. An X direction and a Y direction are two directions perpendicular to the Z direction and orthogonal to each other.

FIG. **12**B is a sectional view of the lighting device **1***h* according to this embodiment.

The shade **20***h* has a substantially spherical shape. For example, the shade **20***h* is arranged to surround the entire lighting unit **10** such that the center point of the shade **20***h* is located in substantially the same position as the lens **130**.

The lower end of the supporting section **21** is supported by the surface of the base **40** and the upper end of the supporting section **21** supports an overlapping portion of the shade **20***h*. The supporting section **21** supports a base **70***b* and a vertex **70***t* of the mirror surface **70**.

The mirror surface **70** is supported by the supporting section **21** to be located right above the lens **130**. The lower surface of the mirror surface **70** is set in a direction tilting in the horizontal direction by an angle set in advance (e.g., 45 degrees) from the direction of the optical axis of the lighting unit **10**. The direction of a video projected by the lighting unit **10** changes from a projecting direction (e.g., 90 degrees).

The lower surface of the mirror surface **70** reflects a video projected from the top of the lighting unit **10** (indicated by a broken line in FIG. **12**B) and projects the reflected video on the side surface on the inside of the shade **20***h*. A direction in which the video is provided is substantially perpendicular to the side surface on the inside of the shade **20***h*. A video user can visually recognize the video displayed on the side surface of the shade **20***h*.

In this modification, a prism (not shown in the figure) may be used instead of the mirror surface **70** as the projecting-direction converting section to change the direction in which the video is projected. Since the member for changing the direction in which the video is projected is provided in this way, it is possible to relax limitation on a positional relation between the lighting unit **10** and the shade **20***h* and increase a degree of freedom of design of the entire lighting device **1***h*.

Another Configuration Example "i" of the Lighting Device

Another configuration example of the lighting device **1** (a lighting device **1***i*) is explained. In the lighting device **1***i*, components same as the components of the lighting device **1** are denoted by the same reference numerals and signs.

FIG. **13** is a schematic diagram showing the configuration of the lighting device **1***i* according to this embodiment.

The lighting device **1***i* includes the lighting unit **10***d* and a shade **20***i* respectively instead of the lighting unit **10***d* and the shade **20** of the lighting device **1** (FIGS. **1**A and **1**B). One surface of the connecting section **210** is fixed to a wall surface **80**.

The terminal end of the shade **20***i* is fixed to the wall surface **80**. As the shape of the shade **20***i*, the lower left surface is smoothly rounded, the bottom surface is parallel to the horizontal plane, and the upper surface is opened. The entire lighting unit **10***d* is embedded in the space on the inside of the shade **20***i*.

The optical axis of the lighting section **190** faces upward. The lighting section **190** radiates light upward. The optical axis of the video forming section **120** faces downward. A video projected by the video forming section **120** is projected on the inside of the bottom surface of the shade **20***i* passing through the lens **130***b*. Consequently, the user can visually recognize, from below, the video displayed on the bottom surface of the shade **20***i*.

A conductor wire (not shown in the figure) may be provided on the wall surface **80** to transmit electric power and a video signal between the operation input section **50** and the connecting section **210** and between the video input section **60** and the connecting section **210**. Further, the transmission of the video signal may be performed by radio and the wire may be omitted.

In this modification, with the configuration explained above, light radiated upward is reflected on the ceiling **214** and the reflected light is irradiated to the entire room and, on the other hand, the video is displayed on the bottom surface of the shade **20***i*. Therefore, in this modification, display of indirect lighting and the video are realized. The user can view the video under a comfortable lighting environment.

In the example explained above, in FIGS. **6**A and **6**B, the lighting unit **10***b* is suspended from the indoor ceiling **214** and arranged such that the distal end of the lighting unit **10***b* is connected to face downward. However, in this embodiment, lighting units having other configurations, for example, the lighting units **10**, **10***a*, **10***c*, **10***d*, and **10***e* may be set such that the distal ends of the lighting units or the direction in which the video formed by the video forming section **120** is projected faces downward.

Control of a Lighting Function and a Video Displaying Function

Control of a lighting function and a video displaying function in the lighting device **1** according to this embodiment is explained.

In an example explained below, the lighting device **1** includes the lighting unit **10***b* (FIG. **5**).

FIG. **14** is a flowchart for explaining processing related to the control of the lighting function and the video displaying function according to this embodiment.

(Step S**101**) The operation input section **50** receives an operation input through the main switch included in the lighting device **1**. Consequently, a switch circuit of a power supply circuit is closed via the control section **170** and

electric power supplied from the outside is supplied to the lighting unit **10***b* (main SW ON). Thereafter, the processing proceeds to step **S102**.

(Step **S102**) The control section **170** reads out menu information, which is information indicating a list of lighting functions of the lighting device **1**, from a storing section (not shown) included in the control section **170** and displays a menu information based on the read-out menu information on a display section (e.g., a display; not shown in the figure) (menu display). Thereafter, the processing proceeds to step **S103**.

(step **S103**) The control section **170** determines whether only an operation input related to lighting of a light among operation inputs received by the operation input section **50** is selected. When it is determined that only the operation input related to the lighting of the light is selected (YES in step **S103**), the processing proceeds to step **S113**. When it is determined that an operation input related to video projection is selected (NO in step **S103**), the processing proceeds to step **S104**.

(Step **S104**) The control section **170** determines whether only the operation input related to video projection among the operation inputs received by the operation input section **50** is selected. When it is determined that only the operation input related to video projection is selected (YES in step **S104**), the processing proceeds to step **S105**. When it is determined that the operation input related to lighting of the light is selected (NO in step **S104**), the processing proceeds to step **S109**.

(Step **S105**) When an operation input related to illuminance of the light source section **110** is included in the operation inputs received by the operation input section **50**, the control section **170** selects the illuminance indicated by the operation input. The illuminance of the light source section **110** can be controlled on the basis of the number of light emitting bodies included in the light source section **110** and a voltage or an electric current supplied to the light emitting bodies. When the operation input related to the illuminance of the light source section **110** is not included, the control section **170** uses illuminance set in advance. Thereafter, the processing proceeds to step **S106**.

(Step **S106**) When an operation input for identifying a video signal output to the video forming section **120** (equivalent to the video signal supply control signal explained above) is included in the operation inputs received by the operation input section **50**, the control section **170** selects the video signal related to the operation input. The video signal is identified using, for example, a channel of an input terminal or a name of a file configured by the video signal (a file name indicating a title or the like of a movie or a program). For example, a video signal based on a broadcast wave or a video signal output by a recording and reproducing device can be identified using a channel of an input terminal. For example, a video signal related to a file name can be identified using the file name. Thereafter, the processing proceeds to step **S107**.

(Step **S107**) The control section **170** causes the light source section **110** to radiate light at the selected illuminance and causes the video forming section **120** to project a video related to the selected video signal. After time set in advance (e.g., one second) elapses, the processing proceeds to step **S108**.

(Step **S108**) The control section **170** determines whether the projection of the video ends. For example, when an operation input received by the operation input section **50** is a stop signal indicating a stop of the projection of the video or when readout and reproduction of a video signal reach the end of the video signal, the control section **170** determines that the projection of the video ends. When it is determined that the projection of the video does not end (NO in step **S108**), the processing returns to step **S107**. When it is determined that the projection of the video ends (YES in step **S108**), the processing proceeds to step **S115**.

(Step **S109**) When the operation input related to illuminance of the light source section **110** is included in the operation inputs received by the operation input section **50**, the control section **170** selects each of illuminances indicated by the operation input. When the operation input related to illuminance of the light source section **110** is not included, the control section **170** uses each of illuminances set in advance. Thereafter, the processing proceeds to step **S110**.

(Step **S110**) When the operation input for identifying a video signal output to the video forming section **120** is included in the operation inputs received by the operation input section **50**, the control section **170** selects the video signal related to the operation input. The processing proceeds to step **S111**.

(Step **S111**) The control section **170** supplies electric power to the light source section **110** and causes the light source section **110** to radiate light at the selected illuminance and causes the video forming section **120** to project a video related to the selected video signal. The control section **170** supplies electric power to the lighting section **190** and causes the lighting section **190** to radiate light. After time set in advance (e.g., one second) elapses, the processing proceeds to step **S112**.

(Step **S112**) The control section **170** determines whether the projection of the video ends. When it is determined that the projection of the video does not end (NO in step **S112**), the processing returns to step **S111**. When it is determined that the projection of the video ends (YES in step **S112**), the processing proceeds to step **S115**.

(Step **S113**) The control section **170** supplies electric power to the light source section **110** and causes the light source section **110** to radiate light. The control section **170** causes the lighting section **190** to radiate light at the selected illuminance (lights the lighting section **190**). After time set in advance (e.g., one second) elapses, the processing proceeds to step **S114**.

(Step **S114**) The control section **170** determines whether to end the radiation of the light (extinguish the lighting section **190**). For example, when an operation input received by the operation input section **50** is an extinguishing signal indicating extinguishing, the control section **170** determines to extinguish the lighting section **190**. When it is determined not to extinguish the lighting section **190** (No in step **S114**), the processing returns to step **S113**. When it is determined to extinguish the lighting section **190** (YES in step **S114**), the processing proceeds to step **S115**.

(Step **S115**) The control section **170** determines whether all functions that the lighting unit **10***b* can perform end. All the functions are, in the example shown in FIG. **14**, projection of a video by the light source section **110** and the video forming section **120** and lighting of the lighting section **190**. When it is determined that all the functions do not end (NO in step **S115**), the processing returns to step **S102**. When it is determined that all the functions end (YES in step **S115**), the processing proceeds to step **S102**.

(Step **S116**) The control section **170** opens the main switch and stops the supply of the electric power to the lighting unit **10***b* from the outside (main SW OFF). Thereafter, the control section **170** ends the processing.

In this embodiment, if the lighting device **1** includes a lighting unit including the lighting section **190** separately from the light source section **110** like the lighting unit **10***b*, for example, the lighting unit **10***c* or the lighting unit **10***d*, the control section **170** can perform the processing shown in FIG. **14**.

If the lighting device **1** includes a lighting unit not separately including the lighting section **190**, for example, the lighting unit **10**, the lighting unit **10***a*, or the lighting unit **10***e*, in FIG. **14**, the control section **170** can execute the processing excluding the processing related to steps S**105** to S**108** in FIG. **14**.

As explained above, in this embodiment, the lighting device **1** includes the lighting unit **10** or the like and the shade **20** or the like that blocks a part of light from the lighting unit **10** or the like. The lighting unit **10** or the like radiates light, modulates the radiated light on the basis of video information, projects a video on the shade **20** or the like, supplies electric power to the light source section **110**, and supplies video information to the video forming section **120**.

Consequently, in this embodiment, it is possible to control lighting and extinguishing according to the operation by the user. Further, it is possible to control projection of a video based on a selected video signal and a stop of the projection of the video. A reproduced video is projected on the shade **20** or the like and visually recognized by the user. Therefore, the user can view, with interest, a video based on an arbitrarily selected video signal. The lighting device **1** is useful as, for example, a part of furniture in a living room or a bedroom.

Second Embodiment

A second embodiment of the invention is explained. Components same as the components in the first embodiment are denoted by the same reference numerals and signs. The explanation in the first embodiment applies to the second embodiment.

FIG. **15** is a schematic diagram showing the configuration of a lighting device **2** according to this embodiment.

The lighting device **2** according to this embodiment includes an input/output processing section **220**. The input/output processing section **220** includes a housing section **250** configured to detachably house a communication device **300**. Like the operation input section **50**, the input/output processing section **220** receives, using the communication device **300**, operation inputs related to presence or absence of lighting of the lighting section **190**, selection of a video signal, and reproduction of a video and a stop of the reproduction of the video. When the communication device **300** is housed in the housing section **250**, a control section **170***j* controls, on the basis of an operation input received by the communication device **300**, presence or absence of lighting of the lighting section **190**, selection of a video signal to be output to the video forming section **120**, or reproduction of a video and a stop of the reproduction of the video.

The communication device **300** has, for example, a function of acquiring and storing a video signal, a function of outputting a video signal, a function of receiving an operation input, and a function of displaying a video. As a specific example, various devices such as a portable terminal device and a multi-function cellular phone (a so-called smart phone) may be used. In this embodiment, a terminal device used in general such as the portable terminal device or the multi-function cellular phone is used as the communication device **300**.

The input/output processing section **220** includes an operation panel **221** functioning as the operation input section **50**, a mounting detecting section **222**, a control-information input section (a serial-interface communication section) **223**, a light-source control section **224**, a communication control section **225**, a USB control section **226**, a language setting section **227**, a power supply circuit **228**, a video input terminal group (a video input section) **230** functioning as the video input section **60**, a video-input selecting section **231**, a video processing section **232**, a sound input terminal group (a sound input section) **240**, a sound-input selecting section **241**, a sound processing section **242**, a sound output section **243**, a speaker **245**, a housing section (a lighting-device side connector) **250**, a network communication section **260**, a multimedia-data processing section **261**, a USB communication section **262**, an external connection section **270**, and the control section **170***j*. In FIG. **15**, the communication device **300** is mounted on the housing section **250**. The lighting unit **10** includes a video-projection driving section **121** besides the light source section **110**, the video forming section **120**, and the lens **130**.

The control section **170***j* outputs signals explained below to the sections and controls the operations of the sections on the basis of an input operation input signal to realize lighting/extinguishing of a light, selection of a video signal, projection of a video, and the like. The control section **170***j* is, for example, a CPU (Central Processing Unit).

The operation panel **221** includes a plurality of keys and the like for receiving an operation input by a user. Examples of the keys included in the operation panel **221** include a "power key" for performing ON and OFF of a power supply, an "input switching key" for switching an input terminal to which a video signal and the like are input, a "lighting key" for switching lighting and extinguishing of the lighting section **190**, and a "projection key" for instructing projection of a video by the video forming section **120**.

When the user operates the operation panel **221**, the operation panel **221** outputs an operation input signal corresponding to an operation input by the user to the control section **170***j*. The operation panel **221** may include a remote-control-signal transmitting section (not shown in the figure). The input/output processing section **220** may include a remote-control-signal receiving section (not shown in the figure). The remote-control-signal transmitting section transmits the operation input signal to the remote-control-signal receiving section as a radio wave. The remote-control-signal receiving section receives the operation input signal from the remote-control-signal transmitting section and outputs the received operation input signal to the control section **170***j*. The operation panel **221** may include a display section for displaying the menu explained above.

The mounting detecting section **222** is connected to a mounting information input terminal included in the housing section **250**. The mounting detecting section **222** detects whether the communication device **300** is mounted on the housing section **250**. The mounting detecting section **222** generates a mounting detection signal indicating whether the communication device **300** is mounted and outputs the generated mounting detection signal to the control section **170***j*.

The control-information input section **223** is connected to a control information input terminal included in the housing section **250**. A control signal is input to the control-information input section **223** from the communication device **300** using, for example, a serial interface. The control-information input section **223** outputs the input control signal to the control section **170***j*. Examples of the control

signal input to the control-information input section **223** include a media operation input signal based on an operation input received by an operation input section included in the communication device **300** and a projection start signal indicating a start of projection of a video based on a timing section included in the communication device **300**. Besides, the control signal includes, for example, language information indicating a language used by the communication device **300** for display and reception request information for requesting reception of a video signal, i.e., multimedia data from a network.

The light-source control section **224** controls the supply of electric power to the light source section **110** and a stop of the supply of electric power on the basis of a light source control signal input from the control section **170***j*. Consequently, it is possible to perform lighting and extinguishing by the light source section **110** and change illuminance.

The communication control section **225** transmits a communication control signal input from the control section **170***j* to the network communication section **260** and controls transmission and reception of a data signal performed using a network (not shown in the figure) connected to the network communication section **260**.

The USB control section **226** outputs a USB control signal input from the control section **170***j* to the USB communication section **262** and controls USB communication with the communication device **300**.

The language setting section **227** includes, for example, a nonvolatile memory. The language setting section **227** stores, in the memory in advance, menu information and language setting values for identifying languages used in displaying a message and the like in an operation input. The control section **170***j* reads and writes a language setting value stored in the language setting section **227**.

Electric power, for example, alternating-current 100V commercial power is supplied to the power supply circuit **228** from the outside. The power supply circuit **228** converts supplied alternating-current electric power into direct-current electric power having a voltage set in advance and supplies the converted electric power to the sections of the lighting device **1**. The power supply circuit **228** can change, on the basis of a power control signal input from the control section **170***j*, main power required for projection of a video, reproduction of sound, and the like and standby power in the supply of the main power. The standby power is electric power required for supplying the main power again when the supply of the main power is stopped. Usually, the standby power is particularly smaller than the main power (e.g., about 1/1000). The power supply circuit **228** is connected to a power supply terminal included in the housing section **250**. The power supply circuit **228** supplies electric power to the communication device **300**.

The video input terminal group **230** includes a plurality of video input terminals to which video signals of various forms can be input from an external video supply apparatus (not shown in the figure) such as a video reproducing apparatus or a personal computer. The video input terminal group **230** outputs each of the video signals input from the video input terminals to the video-input selecting section **231**.

The video-input selecting section **231** selects, on the basis of a video selection signal input from the control section **170***j*, one video signal among video signals input from the plurality of video input terminals included in the video input terminal group **230** and the video input terminal included in the housing section **250** (i.e., video signals output from the communication device **300**) and video signals input from the control section **170***j*. The video-input selecting section **231** outputs the selected video signal to the video processing section **232**.

The video processing section **232** converts the video signal input from the video-input selecting section **231** into driving voltage data indicating a driving voltage applied to pixels included in the video forming section **120**. The driving voltage data indicates, for example, tones of the pixels of the video forming section **120**. The video processing section **232** may perform, on the basis of a video adjustment signal input from the control section **170***j*, concerning the converted driving voltage data, processing related to various kinds of image quality adjustment such as adjustment of brightness, contrast, sharpness, and a tint and gamma correction. The video processing section **232** may superimpose, on the converted driving voltage data, OSD driving voltage data based on an OSD image signal indicating an OSD (on screen display) image. The video processing section **232** outputs the converted or adjusted driving voltage data to the video-projection driving section **121**.

The video-projection driving section **121** applies a voltage based on the driving voltage data input from the video processing section **232** to each of the pixels included in the video forming section **120**. Consequently, the video forming section **120** forms an image based on the selected video signal. The formed image is projected on the shade **20** passing through the lens **130**.

The sound input terminal group **240** includes a plurality of sound input terminals to which sound signals can be input from an external sound supply apparatus (not shown in the figure) such as a video reproducing apparatus or a personal computer. The sound input terminal group **240** outputs the sound signals respectively input to the sound input terminals to the sound-input selecting section **241**.

The sound-input selecting section **241** selects, on the basis of a sound selection signal input from the control section **170***j*, one sound signal out of sound signals input from the plurality of sound input terminals and a sound input terminal included in the housing section **250** (i.e., sound signals output by the communication device **300**) or sound signals input from the control section **170***j*. The sound-input selecting section **241** outputs the selected sound signal to the sound processing section **242**.

The sound processing section **242** subjects, on the basis of a sound adjustment signal input from the control section **170***j*, the sound signal input from the sound-input selecting section **241** to processing for adjusting an output characteristic of the sound signal. The sound processing section **242** outputs the sound signal subjected to the processing to the sound output section **243**.

The sound output section **243** amplifies the sound signal input from the sound processing section **242** and outputs the amplified sound signal to the speaker **245**. The speaker **245** reproduces sound based on the sound signal input from the sound output section **243**.

The housing section **250** includes a plurality of input/output terminals for inputting and outputting data to and from the operation input device **300**. As the input/output terminals included in the housing section **250**, there are, for example, a sound input terminal for inputting a sound signal, a video input terminal for inputting a video signal, a mounting detection input terminal for inputting a mounting detection signal indicating whether the communication device **300** is mounted, an operation input terminal for inputting an operation input signal from the communication input device **300**, a USB terminal for outputting multimedia data from the

USB communication section **262**, and a power supply terminal for outputting electric power from the power supply circuit **228**.

When the communication device **300** is mounted on the housing section **250**, a connector **340** of the communication device **300** and a connector of the housing section **250** fit with each other. Various signals such as a video signal, a sound signal, and an operation input signal can be input and output via the input/output terminals. Further, electric power can be supplied from the lighting device **2** to the communication device **300**.

The network communication section **260** is connected to a wide area network such as the Internet by wire. The network communication section **260** transmits and receives data on the basis of a communication control signal input from the communication control section **225**. The network communication section **260** receives multimedia data including a video signal and a sound signal from a communication apparatus (not shown in the figure) such as a server apparatus in a remote location and outputs the received multimedia data to the multimedia-data processing section **261**. The network communication section **260** is connected to a network and performs communication using, for example, a TCP/IP protocol.

The multimedia-data processing section **261** accumulates the multimedia data input from the network communication section **260** as a file on the basis of a multimedia data processing signal input from the control section **170***j*. The multimedia-data processing section **261** performs conversion processing to convert the accumulated multimedia data into a format for enabling USB communication and outputs the processed multimedia data to the USB communication section **262**.

The USB communication section **262** is a communication unit configured to perform communication conforming to the USB (Universal Serial Bus) standard. The USB communication section **262** is connected to the USB terminal of the housing section **250**. The USB standard is one of serial bus standards for connecting peripheral equipment to a computer. The USB terminal of the housing section **250** is connected to a USB receiving section (not shown in the figure) on the inside of the communication device **300** via the connector **340** of the communication device **300**. The USB communication section **262** outputs the multimedia data input from the multimedia-data processing section **261** to the communication device **300** according to the USB control signal input from the USB control section **226**.

The external connection section **270** includes a radio communication section **271** and a USB communication section **272**.

The radio communication section **271** is connected to a wireless network such as a public wireless communication network or a small wireless communication network (a wireless LAN (Local Area Network). The radio communication section **271** transmits and receives data by radio. The radio communication section **271** receives multimedia data including a video signal and a sound signal from a communication apparatus (not shown in the figure) such as a server apparatus in a remote location by radio and down-converts the received multimedia data from a radio frequency band to a base frequency band. The radio communication section **271** subjects the multimedia data in the base frequency band to analog-to-digital (A/D) conversion to convert the multimedia data into digital multimedia data. The radio communication section **271** outputs the digital multimedia data to the control section **170***j*. The control section **170***j* outputs the video signal and the sound signal included in the multimedia data input from the radio communication section **271** respectively to the video-input selecting section **231** and the sound-input selecting section **241**.

The USB communication section **272** includes a USB terminal. The USB communication section **272** performs transmission and reception of data between the USB communication section **272** and an apparatus such as a video camera or a personal computer connected to the USB terminal of the USB communication section **272**. The USB communication section **272** outputs multimedia data input from the USB terminal of the USB communication section **272** to the control section **170***j*. The control section **170***j* outputs a video signal and a sound signal included in the multimedia data input from the USB communication section **272** respectively to the video-input selecting section **231** and the sound-input selecting section **241**. The USB communication section **272** may input a video signal indicating not only a moving image but also a still image (a photograph, etc.).

The communication device **300** includes a communication section configured to access a network and receives video content (a video signal) and a sound signal through the accessed network and an input/output interface configured to directly input and output a video signal and a sound signal. The communication device **300** includes a storing section configured to store the received or input video signal or the sound signal and an operation input section (an operation panel **310**) configured to receive an operation input by the user. The communication section may download a video signal and a sound signal from a server apparatus on the network or may receive a video signal and a sound signal from a communication partner's communication apparatus. The communication device **300** includes a control section configured to select the stored video signal or sound signal on the basis of the received operation input and controls whether the selected video signal or sound signal is output, whether a video is reproduced on the basis of the selected video signal, or whether sound is reproduced on the basis of the selected sound signal.

The communication device **300** receives multimedia data from the USB terminal included in the housing section **250** and stores the received multimedia data in a storage medium (not shown in the figure) incorporated therein. As the incorporated storage medium, for example, a hard disk drive or a flash memory can be adopted.

In a state in which the communication device **300** is mounted on the housing section **250**, for example, when the user operates the operation panel **310** in order to perform lighting of a light or reproduction of a video, the communication device **300** generates an operation input signal indicating the supply of electric power. When the user operates the operation panel **310** in order to perform reproduction of a video, the communication device **300** generates an operation input signal indicating the supply of a video signal. When the user operates the operation panel **310** in order to select a video that the user is about to view, the communication device **300** generates an operation input signal indicating a video input terminal (channel) to which a video signal indicating the video to be selected is input or a file of the video signal. The communication device **300** outputs the operation input signal indicating the supply of the video signal to the lighting device **2** via the connector **340**. Consequently, video light is projected by the lighting unit **10***b*. In the communication device **300**, reproduction of a video related to the video signal in the communication

device **300** may be performed simultaneously with the output of the video signal to the lighting device **2** or does not have to be performed.

Control of a Lighting Function and a Video Display Function

Control of a lighting function and a video display function in the lighting device **2** according to this embodiment is explained.

In an example explained below, the lighting device **2** includes the lighting unit **10***b* (FIG. **5**) and the operation input device **300** is mounted on the hosing section **250**.

FIG. **16** is a flowchart for explaining processing related to control of a lighting function and a video displaying function according to this embodiment.

(Step S**201**) A main switch included in the lighting device **2** receives an operation input by the user, closes the power supply circuit **228** via the control section **170***j*, and starts the supply of alternating-current power supplied from the outside to the power supply circuit **228** (main SW ON). The power supply circuit **228** converts the supplied alternating-current power into direct-current power and supplies the converted direct-current power to the sections of the lighting device **2**. Thereafter, the processing proceeds to step S**202**.

(Step S**202**) The amounting detecting section **222** detects whether the communication device **300** is mounted on the housing section **250** (terminal device detection), generates a mounting detection signal indicating whether the communication device **300** is mounted, and outputs the generated mounting detection signal to the control section **170***j*. The control section **170***j* detects various devices connected to the lighting device **2** (device detection). Examples of the devices to be detected include devices connected to the radio communication section **271** and devices connected to the USB communication section **272**. Thereafter, the processing proceeds to step S**203**.

(Step S**203**) The control section **170***j* determines whether the mounting detection signal input from the mounting detecting section **222** indicates that the communication device **300** is mounted on the housing section **250**. When the mounting detection signal indicates that the communication device **300** is mounted on the housing section **250** (YES in step S**203**), the processing proceeds to step S**204**. When the mounting detection signal indicates that the communication device **300** is not mounted on the housing section **250** (NO in step S**203**), the processing proceeds to step S**205**.

(Step S**204**) The control section **170***j* stops the function of the operation panel **221** and receives an operation input from the communication device **300**. For example, the control section **170***j* stops an input of an operation input signal from the operation panel **221** and starts an input of a control signal from the mounting detecting section **222**. Thereafter, the processing proceeds to step S**205**.

(Step S**205**) When the function of the operation panel **221** is stopped, the control section **170***j* recovers the function of the operation panel **221** and stops the operation input from the communication device **300**. For example, the control section **170***j* receives an input of an operation input signal from the operation panel **221** and stops an input of a control signal from the mounting detecting section **222**. Thereafter, the processing proceeds to step S**206**.

(Step S**206**) The control section **170***j* reads out menu information, which is information indicating a list of lighting functions of the lighting device **2**, from a storing section (not shown in the figure) and displays a menu based on the read-out menu information on a display section of the operation panel **221** or the communication device **300** (menu display). Thereafter, the processing proceeds to step S**207**.

(Step S**207**) The control section **170***j* determines whether an operation input related to selection of a menu is received (menu selection). When it is determined that the operation input related to selection of a menu is received (YES in step S**207**), the processing proceeds to step S**208**. When it is determined that the operation input related to selection of a menu is not received (NO in step S**207**), the processing proceeds to step S**202**.

(Step S**208**) The control section **170***j* determines whether an operation input signal input from the operation panel **221** or the communication device **300** includes only an operation input signal related to lighting of a light. When it is determined that the input operation input signal includes only the operation input signal related to lighting of a light (YES in step S**208**), the processing proceeds to step S**216**. When it is determined that the input operation input signal includes an operation input signal related to video projection (NO in step S**208**), the processing proceeds to step S**209**.

(Step S**209**) The control section **170***j* determines whether the operation input signal input from the operation panel **221** or the communication device **300** includes only the operation input signal related to video projection. When it is determined that the input operation input signal includes only the operation input signal related to video projection (YES in step S**209**), the processing proceeds to step S**209**. When it is determined that the input operation input signal includes the operation input signal related to lighting of a light as well (NO in step S**209**), the processing proceeds to step S**213**.

(Step S**210**) The control section **170***j* extracts a video selection signal for selecting a video signal from the operation input signal input from the operation panel **221** or the communication device **300** and outputs the extracted video selection signal to the video-input selecting section **231**. The video-input selecting section **231** selects, on the basis of the video selection signal input from the control section **170***j*, one video signal among video signals input from the plurality of video input terminals included in the video input terminal group **230** and the video input terminal included in the housing section **250** and video signals input from the control section **170***j*. The video-input selecting section **231** outputs the selected video signal to the video processing section **232**. Thereafter, the processing proceeds to step S**211**.

(Step S**211**) The video processing section **232** converts the video signal input from the video-input selecting section **231** into driving voltage data and outputs the converted driving voltage data to the video-projection driving section **121**. The video-projection driving section **121** applies a voltage based on the driving voltage data input from the video processing section **232** to each of the pixels included in the video forming section **120**. Consequently, the video forming section **120** forms an image based on the selected video signal. The formed image is projected. Thereafter, the processing proceeds to step S**212**.

(Step S**212**) The video-input selecting section **231** determines whether the projection of the video ends. For example, a stop signal indicating a stop of the projection of the video is input to the video-input selecting section **231** from the control section **170***j* or when readout and reproduction of an input video signal reach the end of the video signal, the video-input selecting section **231** determines that the projection of the video ends.

The stop signal is a signal input to the control-information input section **223** from the operation panel **221** or the communication device **300** and output to the control section **170***j* as a part of control information. The control section

170*j* extracts the stop signal from the control information input to the control-information input section **223** and outputs the extracted stop signal to the video-input selecting section **231**.

When it is determined that the projection of the video does not end (NO in step S**212**), the processing returns to step S**211**. When it is determined that the projection of the video ends (YES in step S**212**), the processing proceeds to step S**218**.

(Step S**213**) The control section **170***j* extracts a video selection signal for selecting a video signal from the operation input signal input from the operation panel **221** or the communication device **300** and outputs the extracted video selection signal to the video-input selecting section **231**. The video-input selecting section **231** selects, on the basis of the video selection signal input from the control section **170***j*, one video signal among video signals input from the plurality of video input terminals included in the video input terminal group **230** and the video input terminal included in the housing section **250** and video signals input from the control section **170***j*. The video-input selecting section **231** outputs the selected video signal to the video processing section **232**. Thereafter, the processing proceeds to step S**214**.

(Step S**214**) The video processing section **232** converts the video signal input from the video-input selecting section **231** into driving voltage data and outputs the converted driving voltage data to the video-projection driving section **121**. The video-projection driving section **121** applies a voltage based on the driving voltage data input from the video processing section **232** to each of the pixels included in the video forming section **120**. Consequently, an image is projected on the shade **20**.

The control section **170***j* generates a light source control signal indicating lighting of the lighting section **190** and outputs the generated light source control signal to the light-source control section **224**. The light-source control section **224** starts the supply of electric power to the lighting section **190** (see FIG. **5**) on the basis of the light source control signal input from the control section **170***j*. Consequently, the lighting section **190** is lit. Thereafter, the processing proceeds to step S**215**.

(Step S**215**) The video-input selecting section **231** determines whether the projection of the video ends.

When it is determined that the projection of the video does not end (NO in step S**215**), the processing returns to step S**214**. When it is determined that the projection of the video ends (YES in step S**215**), the processing proceeds to step S**218**.

(Step S**216**) The control section **170***j* generates a light source control signal indicating lighting of the lighting section **190** and outputs the generated light source control signal to the light-source control section **224**. The light-source control section **224** starts the supply of electric power to the lighting section **190** (see FIG. **5**) on the basis of the light source control signal input from the control section **170***j*. Consequently, the lighting section **190** is lit. Thereafter, the processing proceeds to step S**217**.

(Step S**217**) The control section **170***j* determines whether a control signal is input from the control-information input section **223** or the communication device **300** and an operation input signal related to extinguishing of a light is included in the input control signal. When the operation input signal related to extinguishing of a light is included in the input control signal (YES in step S**217**), the control section **170***j* generates a light source control signal indicating extinguishing of the lighting section **190** and outputs the generated light source control signal to the light-source control section **224**. The light-source control section **224** stops the supply of electric power to the lighting section **190** (see FIG. **5**) on the basis of the light source control signal input from the control section **170***j*. Consequently, the radiation of light from the lighting section **190** is stopped and the lighting section **190** is extinguished. Thereafter, the processing proceeds to step S**218**. When the operation input signal related to extinguishing of a light is not included in the input control signal (NO in step S**217**), the processing returns to step S**216**.

(Step S**218**) The control section **170***j* determines whether all functions of the lighting device **2** end. All the functions are, in the example shown in FIG. **15**, projection of a video by the video forming section **120** and lighting of the lighting section **190** (see FIG. **5**). When it is determined that all the functions end (YES in step S**218**), the processing proceeds to step S**220**. When it is determined that all the functions do not end (NO in step S**218**), the processing returns to step S**203**.

(Step S**219**) The control section **170***j* opens the main switch (not shown in the figure) and stops the supply of the alternating-current electric power from the outside (main SW OFF). Thereafter, the control section **170***j* ends the processing.

In this embodiment, if the lighting device **2** includes a lighting unit including the lighting section **190** separately from the light source section **110** like the lighting unit **10***b*, for example, the lighting unit **10***c* or the lighting unit **10***d*, the control section **170***j* can perform the processing shown in FIG. **16**.

If the lighting device **2** includes a lighting unit not separately including the lighting section **190**, for example, the lighting unit **10**, the lighting unit **10***a*, or the lighting unit **10***e*, in FIG. **16**, the control section **170***j* can execute the processing excluding the processing related to steps S**214** to S**216** in FIG. **16**.

Consequently, in this embodiment, the housing section **250** detachably houses the communication device **300** that accumulates a video signal. The control section **170***j* switches whether the video signal is output from the communication device **300** to the video forming section **120**. By using the video signal acquired by the communication device **300** and the other functions included in the communication device **300**, the user can more easily perform lighting and viewing of a video. This is useful as, for example, entertainment in a living room or a bedroom.

A part of the lighting devices **1** and **2** in the embodiments explained above, for example, the control sections **170** and **170***j*, the mounting detecting section **222**, the control-information input section **223**, the light-source control section **224**, the communication control section **225**, the USB control section **226**, the video-input selecting section **231**, the video processing section **232**, the sound-input selecting section **241**, the sound processing section **242**, the multimedia-data processing section **261**, and the USB communicating section **262** may be realized by a computer. In that case, a computer program for realizing a control function for the sections may be recorded in a computer-readable recording medium. The sections may be realized by causing a computer system to read the computer program recorded in the recording medium and executing the computer program. The "computer system" is a computer system incorporated in the lighting devices **1** and **2** and includes an OS and hardware such as peripheral equipment. The "computer-readable recording medium" refers to portable media such as a flexible disk, a magneto-optical disk, a ROM, and a

CD-ROM and a storage device such as a hard disk incorporated in the computer system. Further, the "computer-readable recording medium" includes a medium that dynamically retains the computer program for a short time like a communication line in transmitting the computer program via a network such as the Internet or a communication line such as a telephone line or a medium that retains the computer program for a fixed time like a volatile memory in a computer system that functions as a server or a client when the computer program is transmitted. The computer program may be a computer program for realizing a part of the functions explained above or may be a computer program that can realize the functions in combination with a computer program already recorded in the computer system.

A part or all of the lighting devices **1** and **2** in the embodiments may be realized as an integrated circuit such as an LSI (Large Scale Integration). The functional blocks of the lighting devices **1** and **2** may be individually formed as processors or may be formed as processors by integrating a part or all of the functional blocks. A method for circuit integration may be realized not only by the LSI but also by a dedicated circuit or a general-purpose processor. When a technique for circuit integration replacing the LSI emerges according to the progress of the semiconductor technology, an integrated circuit by the technique may be used.

The embodiments of the present invention are explained in detail above with reference to the drawings. However, a specific configuration is not limited to the configuration explained above. Various design changes and the like can be made without departing from the spirit of the present invention. For example, the lighting devices **1** and **2** may include any one of the lighting units **10**, **10***a*, **10***b*, **10***c*, **10***d*, and **10***e* and any one of the shades **20**, **20***f*, **20***g*, **20***h*, and **20***i*.

What is claimed is:

1. A lighting device comprising:

a lighting unit; and

an enclosure configured to cover a part or all of a periphery of the lighting unit and transmit light from the lighting unit, wherein

the lighting unit includes:

a light source section for lighting configured to radiate light;

a video forming section configured to form video light obtained by modulating, on the basis of video information, light from a light source section for video formation configured integrally with or separately from the light source section for lighting and project the video light on the enclosure; and

a light transmitting cover that encloses both the light source section and the video forming section

wherein the video forming section has a lens disposed in one area of a surface of the light transmitting cover, the video forming section projecting the video light on the enclosure through the lens of the light transmitting cover.

2. The lighting device according to claim **1**, wherein the lighting unit further includes a projecting-direction converting section configured to change a direction of the video light projected by the video forming section and project the video light on the enclosure.

3. The lighting device according to claim **1**, wherein

the light source section for lighting and the light source section for video formation are configured separately, and

the lighting unit includes a partition wall section configured to partition a first space in which the light source section for video formation and the video forming section are housed and a second space in which the light source section for lighting is housed.

4. The lighting device according to claim **1**, wherein the video forming section projects the video light in a direction different from a direction of light radiated as lighting by the light source section for lighting.

5. The lighting device according to claim **1**, further comprising a control section configured to switch lighting or extinguishing of the light source section for lighting or a video signal supplied to the video forming section.

6. The lighting device according to claim **5**, further comprising a housing section configured to detachably house a communication device that accumulates a video signal, wherein

the control section switches whether the video signal is output from the communication device to the video forming section.

* * * * *